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Purpose: To improve communication among all segments of the Army scientific community and other Government R&D agencies; to further understanding of Army R&D progress, problem areas and program planning; to stimulate more closely integrated and coordinated effort among Army R&D activities; to express views of leaders, as pertinent to their responsibilities, and to keep personnel informed on matters germane to their welfare and pride of service.

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Forecast Sets FY 72 R&D Effort at \$30.1 Billion

Research and development expenditures in the United States will total \$30.1 billion in 1972, a record representative of combined activities of the federal government, industry, academic and nonprofit organizations.

This is the estimate of forecasters at the Battelle Columbus (Ohio) Laboratories who have made annual predictions on R&D for many years.

Offsetting the \$3.1 billion gain from 1971 to 1972 very substantially, the forecast states, is the factor of continuing inflation of personnel and material costs incident to R&D activities. Increases in these costs in the 1969-72 period will not be fully offset by increased funding.

Complicating the uncertainty of what is termed an "R&D turnaround" is the possibility that the projected 1972 increase may not be realized fully because of slippages in the appropriations-spending process.

The predicted eight percent increase is about double the average increase anticipated for the 1970s. By way of comparison, increases since 1968 are estimated annually at 4.4 percent, 2.6 and 3.7 percent. Previously, the peak for R&D was in 1969.

Breaking down the R&D estimate for Calendar Year 1972 by source of funds, the forecast sees the federal government spending almost \$16 billion; industry, about \$12.7 billion; colleges and universities, nearly \$1 billion; and other nonprofit institutions about \$429 million.

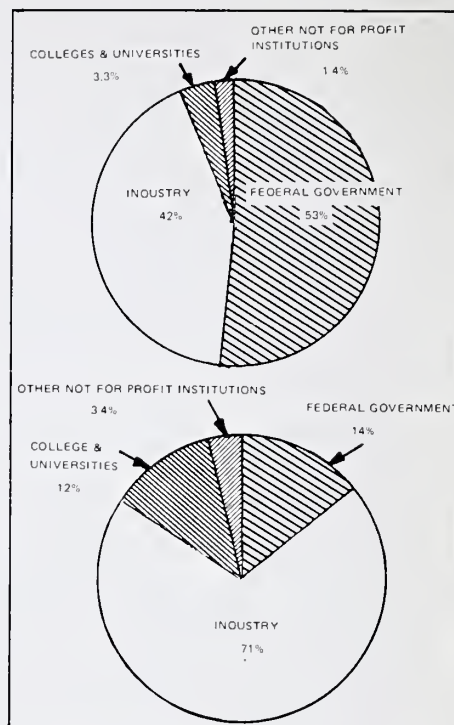
Federal R&D funds in 1972 are expected to be up about \$1.2 billion from the total for 1971, and those provided by industry are likely to be up almost \$1 billion. Colleges and universities are expected to supply \$30 million in additional funds; and other nonprofit institutions up about \$54 million.

The government is expected to be the source of 53 percent of the R&D funds spent in 1972; industry, 42 percent; colleges and universities 3.3 percent; and other sources 1.4 percent. These percentages are quite similar to those for 1971.

The forecast notes that a new set of factors must be taken into account in any attempt to gauge future federal support. Administration and Congressional budgetary constraint has been relaxed by new dependence on direct wage-price controls for reducing inflationary pressures.

Deficit financing has again emerged as an accepted weapon against unemployment and indications are, according to the forecast, that some small part of the deficit will be incurred in support of R&D.

The report says the negative public attitudes toward science seem to be diminishing



1972 R&D Expenditures in the U.S. The total forecast by Battelle's Columbus Laboratories is \$30.1 billion. Distribution shown here is by source of funds (above) and by performance of R&D (below).

and sentiment for the use of R&D as a tool of social and environmental improvement is growing. For this reason, a mild increase in military R&D is anticipated.

All of this, the forecast cautions, must not be taken to imply that earlier forms of pro-R&D thinking have regained their former ascendancy. On the contrary, Congressional skepticism persists and has given rise to a number of changes in federal administration of R&D contracts. The ground rules have changed and are distinctly more strict.

Looking at the prospects for federal support of R&D for the remainder of the decade, the forecast does not expect the annual growth rate to exceed 4 percent before correction for inflation—this despite the 8 percent rise anticipated in 1972.

Rate changes and absolute changes, it points out, have very different implications. For example, from 1959 to 1969, the actual total dollar increase in federal funding of R&D was about \$7 billion, and the annual growth rate was just over 6 percent.

If future growth continues at the lower rate of 4 percent, the next 10 years would still see an increase in dollar volume of \$7 billion. In other words, a growth rate of much less than that of the earlier decade will yield an equal dollar increment.

Although the federal government is the dominant source of research funds, industry performs about 70 percent of all research and is, in its own right, a substantial source of

ABOUT THE COVER: Two air-dropped seismic intrusion detectors (sensors) are shown. One, a cutaway model, shows placement of the component modules which energize the sensor. Components marked T, Z and L are common modules that are adaptable to all kinds of sensors. F3 and A1, not common, are designed for this particular sensor. See article p. 14.

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Selected Army Science Conference Papers Represent Record 257 Authors

2 Army Medics Among 7 Honored for Halting VEE

Two U.S. Army officers are among seven recent recipients of "Superior Service" plaques presented by the Secretary of Agriculture for contributions to the successful program to halt the 1971 epidemic of Venezuelan Equine Encephalitis in Mexico and the southwestern United States.

COL Dan Crozier, MC, commander of the U.S. Army Medical Research Institute of Infectious Diseases at Fort Detrick, Md., and LTC Richard O. Spertzel, VC, chief of the Institute's Animal Assessment Division, received recognition for their important roles.

COL Thomas G. Murnane, VC, chief, Veterinary Research Division, Army Medical R&D Command, accepted the award for LTC

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Army Begins Developing Tactical Transport Fleet

Looking to its combat role in the 1980s, the U.S. Army recently began development work on a fleet of 1,100 new transport utility helicopters that will become the first "true" Infantry squad carriers.

Known as the Utility Tactical Transport Aircraft System (UTTAS), they will be designed to carry an 11-man combat-equipped Infantry squad and a 3-man crew, ferry equipment and supplies into combat, and serve as an airborne command post or an aerial ambulance.

The Army expects the UTTAS to be big, fast, strong, and designed for ease of maintenance. It will have two engines, a ballistically tolerant control system, and armor protection for critical components.

Another characteristic will be a fuel system that reduces the risk of post-crash fires. All these features, according to Army studies, will make the UTTAS highly survivable on the battlefield.

During the first phase of work, the Army

(Continued on page 6)

'The Old Order Changes . . .'

"Change is the way of life," it is said, or as Tennyson put it: "The old order changes, yielding place to new, and God fulfills himself in many ways, lest one good custom should corrupt the world."

Never has the latter quotation been demonstrated more strongly than in the swift pace of current trends. January 1972 marks the beginning of the twelfth year of publication of the Army Research and Development Newsmagazine, which has adhered steadfastly to the operational principles and objectives established when it was founded.

In view of the trends, it is appropriate that this edition marks the initiation of a time-phased program of changes, to be completed by January 1973, in format, layout and the general style of presenting information.

Upon this occasion, with its attendant hopes for continuing improvement, it is happily obligatory to express abiding appreciation to the many information officers and their staffs, as well as to numerous contributors of byline articles, whose efforts have combined to facilitate the tasks of the editorial staff.

Their sustaining cooperation is essential to achieving the goal of making the restylized Army Research and Development Newsmagazine more readable, interesting and effective in serving the missions and functions of agencies participating in Army R&D programs.

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SUPERIOR SERVICE plaque is presented to COL Dan Crozier by then Secretary of Agriculture Clifford M. Hardin for notable contributions to the immunization program that halted the 1971 epidemic of Venezuelan Equine Encephalitis in Mexico and the southwestern United States.

WAC Officer Breaks Precedent in Elite R&D Group

Army Chief of Research and Development LTG William C. Gribble Jr. recently welcomed MAJ Marie D. Ramirez in his Pentagon Office as the first woman to qualify for membership in the Army R&D Officer Program, comprised of a highly selective group.

Director of the Women's Auxiliary Corps BG Mildred Bailey was present for the ceremony, along with Dr. George K. Hess, director, Army Materiel Command Advanced Materiel Concepts Agency, where MAJ Ramirez is assigned. She is the only WAC officer detailed to the Army Chemical Corps.

One hundred technical papers selected for presentation at the U.S. Army biennial Army Science Conference, June 21-23 at the U.S. Military Academy, will be representative of a record number of 257 authors engaged in R&D at Army "in-house" laboratories.

Twenty-five additional supplemental papers have been chosen for presentation if necessary to supplant papers should any be withdrawn. All supplemental papers will be published in the proceedings and considered by a panel of judges in competition with the primary 100 papers for cash honorariums or special awards.

Judges at headquarters levels of the Army Materiel Command, the Office of The Surgeon General, the Office of the Chief of Engineers, and other agencies grouped under the Army Research Office, Office of the Chief of R&D, selected the 125 papers based on narrative summary proposals.

Nearly 500 summaries were submitted from all Army in-house activities. Since the Army Science Conference was initiated in 1957, the distinction of being selected for presentation of a technical paper has engendered increasingly keen competition, evidenced by the gain in summaries.

(Continued on page 2)



FIRST WOMAN TO QUALIFY for the Army R&D Officer Program, MAJ Marie D. Ramirez, is welcomed by Chief of R&D LTG William C. Gribble Jr. At the right is BG Mildred Bailey, director of the Woman's Auxiliary Corps, who joined in congratulations.

Selected Army Science Conference Papers Represent Record 257 Authors

(Continued from page 1)

The Dr. Paul A. Siple Memorial Medallion, initiated at the 1970 ASC, will be the most prestigious of the awards for authors of technical papers. The medallion honors the famed cold regions explorer, Admiral Byrd South Pole Expedition participant, and Army research scientific adviser until his death in 1968.

Under the U.S. Army Incentive Awards Program, it is customary to present about \$3,500 to \$4,000 in cash honorariums to authors of 10 to 15 of the papers selected by a panel of judges representative of the major scientific disciplinary areas.

Certificates of Achievement signed by the Assistant Secretary of the Army (R&D) and the Chief of Research and Development also will be awarded to authors of meritorious papers.

Seventy of the papers selected for presentation are representative of the research performed in in-house laboratories within the U.S. Army Materiel Command, which also accounts for 16 of the supplemental papers. The AMC exercises control over more than 80 percent of all Army laboratory effort.

Quotas for the selection of papers from submission of narrative summaries were established for the AMC, the Office of the Surgeon General, the Office of the Chief of Engineers, and miscellaneous activities—grouped under the heading of Army Research Office, Office of the Chief of R&D.

Under this arrangement, OTSG, OCE and OCRD each will be represented by 10 papers selected for presentation at the conference. Two of the supplemental papers are from OTSG, four from OCRD elements and three from the Corps of Engineers.

Twenty-seven officers and two enlisted scientists are among the 257 authors whose names will appear on the 125 papers. The growing trend in recent years toward teamwork in Army research as opposed to individual effort is reflected by 44 papers with 2 authors, 17 with 3, 9 with 4, 1 with 6 and 1 with 7 authors. Forty-nine papers will report on individual research.

Examination of the titles of the 125 papers serves to indicate the exceptionally broad range of Army research interests—all of which, under criteria established by Congress, must be directed primarily to foreseeable Army objectives, although results also find many applications to civilian uses.

The Army Independent In-house Laboratory Research Program, funded at about \$10 million annually, enables scientists to engage in research of special personal interest other than activities assigned to them in the conduct of the general Army program.

Titles of the papers to be presented, the supplemental papers, authors and the agencies they represent are as follows:

OFFICE, SURGEON GENERAL—*Role of Water Jet Devices in Combat Surgery*, by COL S. N. Bhaskar, Arthur Gross and D. E. Cutright, U.S. Army Institute of Dental Research, Washington, D.C.; *Acid-base Changes in Heat Exhaustion During Basic Training*, by MAJ A. E. Boyd and MAJ G. A. Beller, U.S. Army Research Institute of Environmental Medicine, Natick, Mass.; and

The Automated Dithionite Test for the De-

tection of HbS in Military Personnel. A Technic Evolved from Molecular Concepts, by LTC Frank R. Camp, COL N. F. Conte and Dr. R. M. Nalbandian, U.S. Army Medical Research Laboratory, Fort Knox, Ky.; *The Effect of Folate on Abnormal Carbohydrate Metabolism*, by MAJ H. L. Greene, E. G. Lufkin, R. H. Herman, F. B. Stifel and Y. F. Herman, U.S. Army Medical Research and Nutrition Laboratory, Denver, Colo.; and

Restoration of Drug-resistant Bacteria to Sensitivity to Chemotherapeutic Drugs, by Dr. Fred E. Hahn and Miss Jennie Clark, Walter Reed Army Institute of Research (WRAIR), Washington, D.C.; *Mandibular Bone Grafts with Surface Decalcified Bone*, by COL Gilbert E. Lilly, COL Donald B. Osbon, MAJ John C. Jones and SP5 Perry C. Hackett, Letterman Army Institute of Research, San Francisco, Calif.; and

A Mediator for Triggering Nonspecific Host Defense Mechanisms, by Dr. R. S. Pekarek and R. W. Wannemacher, U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID), Frederick, Md.; *Control of VEE Epizootic-Epidemic by Vaccine Developed at USAMRIID*, by LTC Richard O. Spertzel and COL Dan Crozier, USAMRIID;

Penetration of the Intestinal Epithelium by Various Microorganisms, by Dr. Akio Takeuchi, WRAIR; *Spectral Deficits in Visual Acuity Due to Laser Irradiation*, by Harry R. Zwick, MAJ R. Bruce Bedell and Kenneth Bloom, Frankford Arsenal, Philadelphia, Pa.

CORPS OF ENGINEERS—*Dynamic Response of Reinforced Openings in Rock*, by Dr. Lewis H. Blakey, U.S. Army Engineer Division, North Central, Chicago, Ill.; *ARMIDOP/ZERO-DOP Positioning Technique*, by Joseph F. Hannigan, U.S. Army Engineer Topographic Laboratories (ETL), Fort Belvoir, Va.; *Mapping Seismic Response Characteristics of Complex Terrain*, by L. E. Link and W. F. Marcuson, U.S. Army Engineer Waterways Experiment Station (WES), Vicksburg, Miss.; and

Bridge Response to Explosion Produced Water Plumes, by W. H. McAnally Jr., WES; *A Unified Method of Describing Vehicle Dynamics*, by N. R. Murphy and A. S. Lessem, WES; *Fracture Mechanics Applicability to Portland Cement Concretes*, by Dr. D. J. Naus, U.S. Army Construction Engineering Research Laboratory (CERL), Champaign, Ill.; and

Momentum Transfer from Explosion-Driven Shock Waves to Tree Stems, by Dr. H. Nikodem and J. K. Stoll, WES; *Ice Forces on Vertical Piles*, by Roscoe E. Perham, Donald E. Nevel and Gary B. Hogue, U.S. Army Cold Regions R&E Laboratory (CRREL), Hanover, N.H.; *A Stochastic Network to Model Air Cargo Terminals*, by H. A. Porte and W. W. Happ, CERL; and

Optimization of Resource Allocation in Maintenance Management Logistics Systems, by R. L. Trent, COL E. Martin and J. Wine, CERL.

OTHER R&D AGENCIES—*Advanced High Energy Missile Control Systems*, by Dr. L. C. Atha, U.S. Army Advanced Ballistic Missile Defense Agency (ABMDA), Huntsville, Ala.; *A Helium-Neon Laser Hit-Kill Simulator*, by SP4 W. Curtis, J. Isaacson, E.

Kratschmer, W. Wilson and SP5 B. Yorks, HQ Modern Army Selected Systems Test, Evaluation and Review (MASSTER), Fort Hood, Tex.; and

A Parametric Analysis of the Multiple Artillery Rocket System vs The Improved 8-inch Howitzer, by MAJ F. J. Franks, HQ MASSTER; *Simulation and Comparison of Multi-Variable and Single-Variable Recruit Screening Devices*, by C. D. Johnson and K. W. Haynam, U.S. Army Manpower Resources R&D Center, Arlington, Va.; and

An Extended Finite Differences Method for the Solution of System Problems, by CPT C. R. Loncor, U.S. Military Academy (USMA), West Point, N.Y.; *The Frequency Response of a Pneumatic Tee Junction*, by LTC F. J. Redd and CPT F. Cardile, USMA; *A Probabilistic Model for Structuring a Drainage Network*, by LTC R. T. Robinson, HQ, MASSTER; and

Data Processing for System Analysis, by J. E. Scalf, ABMDA; *Choosing Performance Parameters for a Ground Surveillance Radar with Foliage Penetration Capability*, by L. V. Surgent Jr., U.S. Army Land Warfare Laboratory, Aberdeen Proving Ground, Md.; *Synthetic Aperture Radar Processing Techniques for Ballistic Missile Defense*, by W. W. Watts, ABMDA.

ARMY MATERIEL COMMAND—*Fast Neutron Radiography*, by John J. Antal and Robert L. Becker, U.S. Army Materials and Mechanics Research Center (AMMRC), Watertown, Mass.; *On the Theory of Stopping of Fast Charged Particles*, by Ari Brynjolfsson, U.S. Army Natick Laboratories (NLABS);

Discharge of Helicopters by Electronically Controlled Emission of Charge Carrying Liquid Droplets, by Rodolph G. Buser and H. M. Kaunzinger, U.S. Army Electronics Command (ECOM), Fort Monmouth, N.J.; *Experimental Verification of Theoretical Predictions of Self-Induced Beam Distortion for High Power Density Controllable Beam Weapons System*, by Rudolph G. Buser and CPT Robert S. Rhode, ECOM; and

Use of Magnetic Latitude Simulator and Data Processing in the Development of Sophisticated Land Mine Fuzes, by N. C. Butler, Harry Diamond Laboratories (HDL), Washington, D.C.; *The Detection of Mutagenic Health Hazards with a Mammalian Test System*, by Dr. Robert L. Capizzi and Dr. Bruno Papirmeister, Edgewood Arsenal, Aberdeen Proving Ground (APG), Md.; and

Millimeter Wave Quasi-Optical Techniques for Device and Circuit Functions, by Metro M. Chrepta and Harold Jacobs, ECOM; *Structural Characterization of XP Films as Related to Mechanical Properties and Ballistic Performance*, by C. Richard Desper and Robert W. Lewis, AMMRC; *Analytical Prediction of Vehicle Mobility*, by Howard Dugoff and A. A. Rula, U.S. Army Tank Automotive Command (TACOM), Warren, Mich.; and

Filtering of Time Correlated Data, by Richard Duncan, U.S. Army Test and Evaluation Command (TECOM), White Sands Missile Range (WSMR) N. Mex.; *Theoretical Studies of High Energy Pulsed CO₂ Lasers*, by Charles Cason and Steven J. Kast, U.S. Army Missile Command (MICOM), Redstone

Arsenal, Ala.; *Electronic Processes in Explosives Initiation*, by H. D. Fair Jr., D. S. Downs, A. C. Forsyth, M. Blais and T. F. Gora Jr., Picatinny Arsenal, Dover, N.J.; and *The Ring Foil Grenade*, by Abraham Flatau, Edgewood Arsenal; *Evaluation of Reverse Osmosis Membranes for Army Field Water Purification*, by Allen Ford Jr. and Don C. Lindsten, U.S. Army Mobility Equipment R&D Center (MERDC), Fort Belvoir, Va.; *Midi Radar*, by Charles E. French, U.S. Army Air Defense Board, Fort Bliss, Tex.; and

Friction of Poly (n-Alkyl Methacrylates), by Henry Gisser and Marco Petronio, Frankford Arsenal, Philadelphia, Pa.; *Dynamic Compatibility of Helicopter Propulsion Systems*, by James Gomez and John M. Vance, U.S. Army Air Mobility R&D Laboratory (AMRDL), Fort Eustis, Va.; *Infrared Mine Detection*, by Dwight L. Gravitte, MERDC; and

3-D Optical Augmentation, by Ronald C. Hallendorff, ECOM; *Deformation and Fracture of Tank Bottom Hull Plates Subjected to Mine Blast*, by Donald F. Haskell, U.S. Army Ballistic Research Laboratories (BRL), Aberdeen Proving Ground, Md.; *HELBAT II*, by Gary L. Horley, U.S. Army Human Engineering Laboratories (HEL), Aberdeen Proving Ground, Md.; and

Oscillatory Behavior of Detonating Solid Explosives, by Philip M. Howe and Giordano Melani, BRL; *A New Approach to Digital Signal Detection*, by William A. Huber, ECOM; *Response of Cylindrical Shells to Traveling Load Simulation of X-Ray Blow-Off Impulse*, by N. J. Huffington and John D. Wortman, BRL; and

Development of a Dynamic Model for an Aircraft Gun Turret System, by Tonney H. M. Hung, James T. Wong and Philip E. Townsend, U.S. Army Weapons Command (WECOM), Rock Island, Ill.; *Rare Earth Cobalt Permanent Magnet Materials for Electromechanical Energy Conversion Devices*, by G. Iafraite, R. L. Ross, F. Rothwarf and C. Campagnoulo, ECOM; and

Receiver Design and Evaluation by Computer Simulation, by Dr. T. J. Klein, ECOM; *Isolation and Characterization of a Heat Stable, Highly Sensitive Enzyme for Detection and Identification of Nerve Agents*, by David N. Kramer, Harry G. Michel, William Swain and Miss Ethel Hackley, Edgewood Arsenal; *"Zeta Rays"—A New Phenomenon in Gamma Dose Distribution*, by Stanley Kronenberg, Robert A. Luz, Wolfgang J. Ramm, Kristian I. Nilson, Robert Pfeffer and Harry L. Berkowicz, ECOM; and

A New Emphasis on the Use of Excited Use State g-Factors for the Interpretation of Impurity Ion Spectra, by Dr. S. Kulpa and Dr. N. Karayianis, HDL; *High Ignition Temperature Propellants for Small Arms Caseless Ammunition*, by R. Lantz and E. Costa, Picatinny Arsenal, Dover, N.J.; *The Effects of Vibration on Vision as Applied to Military Vehicles*, by Richard Lee, TACOM; and

Fabrication of Optical Elements by Means of a Low Energy Ion Beam, by James D. Lester, Frankford Arsenal; *Laser Ignition of Aircraft Fuel*, by Ona R. Lyman, BRL; *Optimum Bullet Study*, by L. C. MacAllister, B. J. Reiter, B. B. Grollman and A. E. Thraillkill, BRL; *Disposal of Cellulosic Waste Materials by Enzymatic Hydrolysis*, by Dr. Mary Mandels, NLABS; and

Fabrication of New Composite Materials,

by James W. McCauley, AMMRC; *Design of an Advanced Concept Cooled Radial-Inflow Turbine*, by J. L. Means and H. E. Rohlik, U.S. Army Air Mobility R&D Laboratory (AMRDL), Hampton, Va.; *A BRL Lightweight Armor Concept*, by A. Merendino, J. M. Regan and W. Jones, BRL; and

Improved Interior Ballistics for Recoilless Rifles, by E. K. Merz and F. A. Brody, Picatinny Arsenal; *The Measurement and Analysis of Fatigue Crack Growth in Thick-Walled Cylinders*, by J. J. Miller, R. R. Fuczak and D. C. Winters, Watervliet Arsenal, Watervliet, N.Y.; *Hand-Held Laser Rangefinder (AN/GVS-5)*, by R. J. Newton, F. A. Kobylarz and R. P. Tuttle, ECOM; and

The Metra Technique, by Guy F. Origlio, MERDC; *A Theoretical and Experimental Investigation of Flap-Lap Dynamics of Torsionally Rigid, Hingeless Helicopter Rotor Blades*, by Robert Ormiston and William Bousman, AMRDL; *Measurement of the Angular Distribution of Photoelectrons from Third Generation Photocathode Materials*, by J. H. Pollard, ECOM; and

An Intensive Approach to the Study of Materials Deterioration in the Tropics, by Dr. Wilfried H. Portig and George Gauger, U.S. Army Tropic Test Center, Fort Clayton, Canal Zone; *Stress Singularities Associated with a Crack Inclined to a Bi-Material Interface*, by S. L. Pu, R. D. Scanlon and M. A. Hussain, Watervliet Arsenal; and

Increased Density for Military Foods, by A. R. Raham, W. L. Henning, S. Bishov and D. E. Westcott, NLABS; *Shaped Charge Liner Collapse and Jet Formation-Analytical and Experimental Investigations*, by G. Randers-Pehrson, Picatinny Arsenal; *The Effect of Burial on Fragmentation Munition Effectiveness*, by Mark Reches, U.S. Army Materiel Systems Analysis Agency, Aberdeen Proving Ground, Md.; and

Doppler Translator, by Otto E. Rittenbach, ECOM; *Studies in Personnel Detection Radar*, by C. A. Roberts, R. T. Antony and S. J. Peperone, HDL; *Electrical Simulation of the Internal Electromagnetic Pulse*, by John A. Rosado, HDL; *Analysis of Band Pressure in a Gun Tube Using Finite Elements and Shell Pushing Data*, by Stephen G. Sawyer and John M. Hurban, BRL; and

Application of Image Up Conversion to Night Fire Control, by Joseph Schmitz, Frankford Arsenal; *Laser Assisted Low Energy X-Ray Flash Generation*, by Romas A. Shatas, John D. Stettler, Harry C. Meyer and Thomas G. Roberts, MICOM; *A Novel Synthesis of HMX*, by V. I. Siele, M. Warman, J. Leccacorvi and E. E. Gilbert, Picatinny Arsenal; *Spectroscopic Studies of Luminescence Emitted by Dyes Irradiated by Laser Light*, by J. A. Sousa and J. F. Roach, NLABS; and

An Analysis of 5.56mm Aluminum Cartridge "Burn-Through" Phenomenon, by Walter Squire and Reed Donnard, Frankford Arsenal; *High Temperature Polyamides from a New Hexahydrobenzodipyrrole Monomer*, by John T. Stapler and Joseph Bornstein, NLABS; *A Vaccine Against Organophosphorus Poisoning*, by Ludwig Sternberger, Van M. Simm, William G. Kavanagh, John J. Cuculis, Howard G. Meter, David E. Lenz and Dinnis M. Hinton, Edgewood Arsenal;

Lightweight, Small Laser Transmitter Design for Rangefinders, by John W. Strozyk, MAJ John Hynd and CPT Jesse Moss,

ECOM; *US Ran3, A New Field Implementable Technique to More Accurately Locate Enemy Artillery by Sound Ranging*, by Donald M. Swingle, Dr. Craig Crenshaw and Raymond Bellucci, ECOM; *Experiment to Assess Capabilities of an Automated Small Arms Test Facility*, by COL Charles B. Thomas, U.S. Army Infantry Board, Fort Benning, Ga.; and

The Mechanism of Action and Treatment of Palytoxin Poisoning, by MAJ James A. Vick and Joseph S. Wiles, Edgewood Arsenal; *Growth of Large Single Crystals of Al₂O₃ by the Gradient Furnace Technique for Transparent Armor Applications*, by D. Viechnicki and F. Schmid, AMMRC; *Effect of Ingot Thermal Mechanical Processing Treatments on the Grain Size and Mechanical Properties of Wrought 7075 Alloy*, by J. Waldman and H. Sulinski, Frankford Arsenal; and

A Unique Heterogeneous Explosion at Liquid Nitrogen Temperature (77° Kelvin), by Carl R. Wellman, BRL; *The Kinetics and Mechanism of the Binary BG Reaction as Determined by NMR Spectroscopy*, by R. L. Wintermyer, Miss Linda Szafraniec, Harvey R. Bradford and Harold Klapper, Edgewood Arsenal; *New Method for Preparing Ceramic Oxides with Unprecedented Electronic Properties*, by R. J. Zeto, E. Hryckowian and C. D. Bosco, ECOM.

Supplemental papers follow:

OFFICE, SURGEON GENERAL—*A Unified Mechanism for the Process of Calcification in Hard and Soft Tissues*, by F. Leonard, C. W. R. Wade, A. F. Hegveli, J. W. Boke and R. J. Ruderman, Walter Reed Army Medical Center, Washington, D.C. *Ocular Hazards of the GaAs Laser*, by D. J. Lund, C. Carver and MAJ R. B. Bedell, Frankford Arsenal.

CORPS OF ENGINEERS—*Accurate Ephemeris Time Determination and Geocentric Stations Position from Photographs of the Moon Against Stellar Background*, by Dr. Angel A. Baldini, U.S. Army Engineer Topographic Laboratories (ETL), Fort Belvoir, Va.; *Image Area Measurement Using a Sensor Array System*, by Dr. Pi Fuay Chen and William W. Seemuller, ETL; *Explosive Excavation Development for Construction and Combat Applications*, by LTC R. L. La Frenz and W. C. Day, WES.

OTHER R&D AGENCIES—*Vibrational Spectrum of the Nitrite Ion Isolated in Alkali Halide Lattices*, by D. J. Gordon and D. F. Smith Jr., USMA; *Molecular Orbital Theory as Applied to Fulvene Reactions*, by LTC Robert B. Henry, Office of the Chief of Research and Development, HQ DA; *Induced Swirl in a Stratified Charge Wankel Engine*, by CPT D. Hoon and MAJ A. K. Kuschner, USMA; *The Northwest Passage: Feasibility and Future*, by LT J. S. Horner, 1st Field Army Support Command, Fort Lee, Va.

ARMY MATERIEL COMMAND—*A Thixotropic Fuel for Tactical Missiles*, by Barry D. Allan, MICOM; *"Frontal Pressure" as a Second Arming Environment for Fuzes Launched from Smooth Bore Barrels*, by R. S. Andrejkovics, Frankford Arsenal; *Stability of Ammonium Nitrate as Inferred from Structural and Lattice-Dynamical Studies*, by C. S. Choi, Z. Iqbal, H. J. Prask and S. F. Trevino, Picatinny Arsenal; and

Dynamic Response Index (DRI) Minimization for Personnel Escape Systems, by L. A.

TECOM Accents New Equipment Training Program

New equipment training is an important phase of operations of the U.S. Army Test and Evaluation Command (TECOM), Aberdeen Proving Ground, Md., the Army Materiel Command's principal testing organization.

Formal instruction in the function, operation and maintenance of test items arriving in the form of prototypes or early production models is usually necessary as a preliminary to performance of the evaluation.

Training may encompass several areas including operator training, maintenance training, staff planning and specialized supervisory technical training. During FY 1971, schooling was conducted for more than 500 personnel at developer and contractor facilities. They attended a total of 60 courses averaging two to four weeks and covering 44 separate materiel items.

TECOM's workforce of nearly 16,000 is stationed at 15 proving grounds, service test boards and environmental test centers. Military and civilian personnel are skilled in about half the Army's military occupational specialties and a like proportion of occupational codes listed by the U.S. Civil Service Commission.

Personnel selected for a test project usually are highly qualified in their respective fields. Still they must be given the specific knowledge and proficiency required for programs.

New equipment training given by TECOM generally falls into four categories. As a rule, instruction is conducted before similar training can be offered by service schools or training centers, because the tester's work must be completed before production can begin.

Operator training, for example, prepares individuals and teams to handle new or modified equipment and, usually, to perform organization-level maintenance. Student input ranges from individual radio operators, tankers and truck drivers to gun crews, missile teams and Army aviation companies.

Maintenance training is directed at the technicians and specialists responsible for maintaining and servicing test hardware, support equipment and associated items during the conduct of the tests. Courses cover organization-level, direct and general support



TROOPS locate target during gunner training phase of the U.S. Army Air Defense Board's testing of the 20mm Vulcan.

Edgewood Glassblowers Fashion Scientific Apparatus

Five Edgewood (Md.) Arsenal employees are using the ancient art of glassblowing to provide quickly and cheaply a variety of research apparatus.

Among more than 600 experienced glass technicians working in the U.S., they are employed in the Chemical Research and in the Medical Research Laboratories.

Frank DeCesare, employed in 1941 as an apprentice, was named chief of the glassblowing branch in 1960. *Walter Steinke*, a glassblower at Mine Safety Appliance Co. in 1952, came to the arsenal in 1959.

Hugo Biermann and *William Chabot* graduated from a 2-year course in glassblowing at Salem County Technical Institute, prior to coming to the arsenal. *Elmo Maiolatesi* began his glassblowing career at the age of 15. Director, Baltimore/Washington, D.C. Chapter of American Scientific Glassblowers Society, he says that the glassblowing profession is a mixture of science and art.

Skilled manipulation and the proper amount of heat are now the essential factors in glassblowing, he explains—"glassblowers with bulging rubbery cheeks are characteristic of the old bottle blowers and are largely a thing of the past."

The tools and techniques of glassblowing, developed by Phoenicians over 2,000 years ago, are basically unchanged. Mechanization has been provided by special lathes.

The arsenal glassblowers produce items varying in size and shape but most are large

and contain many intricate parts. Glass tubing ranging from 1/16 of an inch up to 4 inches in diameter is used in the process.

Blue-tinted didium lenses are worn by the glassblowers, helping to eliminate the bright-yellow sodium light produced when glass is heated by a torch similar to that used by a welder.



GLASSBLOWER Elmo Maiolatesi examines special glass apparatus he created at the Medical Research Laboratory, Edgewood Arsenal, Md. Maiolatesi is director, Baltimore-Washington Chapter, American Scientific Glassblowers Society.

maintenance procedures, and instrumentation and calibration techniques.

Representative of these two phases are the preparations under way to test TACFIRE—the artilleryman's highly automated tactical fire direction system now in the final stages of development.

To date, 92 operators and maintenance personnel have been trained by Litton Industries in three different courses conducted at the company's plant in Van Nuys, Calif. All are slated to participate in upcoming TACFIRE tests which will be performed by the Field Artillery Board at Fort Sill, Okla., and by White Sands Missile Range in New Mexico. Of this group, 76 operators were trained for the Field Artillery Board alone.

Staff planners also come in for a goodly share of attention. This portion of the program is aimed at preparing staff members of TECOM, major Army commands and the Department of Defense to plan, program and budget for the development of and training on new equipment. Training is initiated when development progress indicates probable Army acceptance of the materiel in question.

Specialized supervisory technical training is provided for test project officers, test engineers, technical and scientific personnel and research and development coordinators. These high level courses are intended to equip them to design, plan, supervise or evaluate materiel tests.

ASC Papers Represent Record 257 Authors

(Continued from page 1)

Destefano, Frankford Arsenal: *A Three-Frequency Heterodyne Laser Communications System for Army Tactical Applications*, by Dr. Larry Dworkin and Jack Zavin, ECOM; *Development and Validation of Mathematical Models of Howitzer, Medium, Towed: 155mm XM198*, by J. W. Frantz and M. C. Nerdahl, WECOM; and

Radar Arrays with No Phase Shifters, by R. L. Hartman, MICOM; *Formation and Reactions of Azide Radicals*, by E. Hayon, NLABS; *A New Approach to Thin Layer Broadband Radar Absorbers*, by Gilbert McCall, ECOM; *Carbon Fibers; Reexamination of the Critical Low-Temperature (200-300° C.) Stabilization of Polyacrylonitrile*, by J. S. Perkins, R. E. Sacher, S. E. Wentworth, C. R. Desper and G. R. Thomas, AMMRC; and

Laboratory Research on the Incineration of Mustard, by Samuel Sass and Paul M. Davis, Edgewood Arsenal; *Problems in the Arbovirology of the Bonneville Basin, Utah*, by Keith L. Smart, Deseret Test Center, Fort Douglas, Utah; *Scattering of an Electromagnetic Pulse (EMP) by Apertures in Metal Structures*, by Werner J. Stark, HDL;

Measures and Countermeasures for Neutralization of Buried Pressure Electric Mines, by Samuel Stiber, George Haber and Joseph Curran, ECOM; *The Adsorption and Reaction of Unsaturated Cyclic Hydrocarbons on a Fuel Cell Electrode*, by CPT R. J. Uork, H. J. Barger Jr. and G. W. Walker, MERDC; *Near Optimal Takeoff Performance of a Heavily Loaded Helicopter in Ground Effect*, by C. Rande Vause and Dr. Fredric Schmitz, AMRDL.

Vinson, Salter Assume New Directorate Positions

Leadership in two of the five directorates within the Office of the Chief of Research and Development, HQ DA, changed in mid-November when BG Wilbur H. Vinson Jr. became Director of Plans and Programs. BG Sylvan E. Salter succeeded him as Director of Missiles and Space.

BG Vinson, who also will serve as Deputy Chief of R&D for International Programs, took over from MG John W. Barnes, who has departed for a new assignment with the Military Assistance Advisory Group (MAAG) in Taiwan.

Following completion of a tour of duty as CG of I Corps (Group) Artillery in Korea, BG Vinson reported for duty as director of Missiles and Space, OCRD, in March 1971. He served with OCRD as chief, Nike-X and Space Division (1967-68), and staff officer with the Nike-X Branch, Antiballistic Missile Office (1962-65).

During a 1966-67 tour of duty in Vietnam, he commanded the 2d Battalion, 19th Artillery and then was deputy CO, 1st Cavalry Division Artillery.

A 1945 graduate of the USMA, he received an MS degree in mechanical engineering from the University of Southern California in 1962. He has completed the National War College course (1966) and Command and General Staff College (1957).

His military honors include the Silver Star, Legion of Merit with three OLC, Bronze Star Medal with OLC, Meritorious Service Medal, Air Medal with five OLC, and Army Commendation Medal.

BG Salter served as CG of the 31st Artillery Brigade (Air Defense), Homestead Air Force Base, Fla., prior to his most recent assignment with OCRD.

During 1968-70, he was a member of the Strategic Defense Branch, Requirements and



BG Wilbur H. Vinson Jr.

Developments Division, Joint Chiefs of Staff, Washington, D.C.

Other assignments have included: CO of the 4th Missile Battalion, 57th Artillery, U.S. Army, Europe (1965-67); staff officer and then chief, Ballistic Missiles Branch, Air Defense and Missiles Division, OCRD (1961-65); and special weapons plans officer, Plans and Policy Division, G-3, Eighth U.S. Army, Korea (1960-61); and assistant director, Field Support Division, Army Ballistic Missile



BG Sylvan E. Salter

Agency (1956-59).

A 1945 graduate of the USMA, General Salter has completed the Industrial College of the Armed Forces course (1968) and the Command and General Staff College (1960). He received an MS degree in aeronautics and guided missiles from the University of Southern California in 1950.

His military honors include the Legion of Merit with two OLC and the Meritorious Service Medal.

HumRRO Sees Good Start in Optimized Training

Reviewing the new systems engineering concepts being applied in Army schools, the Human Resources Research Organization (HumRRO) recently reported that a promising start is being made in development of optimized training programs.

In the study, sponsored by the Office of the Chief of Research and Development, HQ DA, HumRRO evaluated the large-scale effort initiated by the Army in 1968 to bring all training programs under systems engineering concepts within a 5-year period. This review was

undertaken one year after the program's inception at one of the Army training schools.

Titled "Implementation of Systems Engineering Concepts in Army Training," the HumRRO report focuses on an Army-developed systems engineering guide published as CONARC Regulation 350-100-1, "Systems Engineering of Training."

The guide was reviewed and reduced to outline form in the report, which also includes a graphic display of the products and sub-products of information used in the evaluation.

Copies of the report, labeled Professional Paper 11-71, are available at: Human Resources Research Organization, 300 N. Washington St., Alexandria, Va. 22314.

CEEIA Tech Director Caps 7-Year Rise From 1LT

Advancement from first lieutenant to technical director of the U.S. Army Communications Electronics Engineering Installation Agency within seven years is part of Leonard J. Mabius' success story.

In July 1964, 1LT Mabius reported to the Army's worldwide Strategic Communications Command (STRATCOM) following two years as communications officer of the first Pershing missile battalion to be organized.

While assigned to the battalion, he developed five communications design improvements and, in recognition, was awarded the Army Commendation Medal.

Mabius is now the scientific and engineering consultant/adviser to the CEEIA commanding general and staff.

Before joining CEEIA he served as deputy director for Systems Engineering with STRATCOM's Safeguard Communications Agency (SAFCA). There he was responsible for the total system and detailed equipment design of Safeguard ballistic missile systems communications.

During his first STRATCOM assignment, he served in Europe as chief of program management for voice, digital, security and special Presidential communications systems. He was responsible for management of an engineering and development program to interface military communications with European systems, which involved relocating some U.S. communications in France.

In July 1967, he left the Army with the rank of captain to take a position with Philco-Ford Corp. in Philadelphia and he was a program manager for four Department of Defense contracts.

Mabius earned a BS degree in electrical engineering from Rutgers University in 1961.

JAN.-FEB. 1972



Leonard J. Mabius

Mobile Microwave Testing Unit Developed at Fort Huachuca

A Mobile, Automated Microwave Test Facility (MAMTF) has been developed by the U.S. Army Strategic Communications Command, Fort Huachuca, Ariz.

Equipped to gather data on signal degradation in line-of-sight microwave, tropospheric scatter and satellite communications transmission, the MAMTF is contained in an S-280 mobile shelter. An automated network analyzer works in tandem with a terminal measuring antenna input/out. MAMTF data will be used to upgrade existing equipment and will become part of the data base for development of new equipment.

David S. Oishi, an electronic engineering intern with STRATCOM's Office of the Assistant Chief of Staff for Force Development, designed and engineered the facility. It is undergoing extensive tests to determine the technical performance characteristics of defense communications satellite terminals.

2 Army Medics Among 7 Honored for Halting VEE

(Continued from page 1)

Spertzel, who could not be present to accept the personal congratulations of then Secretary of Agriculture Clifford M. Hardin.

COL Crozier was cited "for his outstanding contribution as commanding officer of the Fort Detrick Research Unit which developed and supplied the Venezuelan Equine Encephalomyelitis vaccine responsible for preventing a major epidemic."

LTC Spertzel was commended "for his outstanding contribution as chief technical adviser for the Houston, Tex., Headquarters of the Venezuelan Equine Encephalomyelitis Emergency Program." He has been serving at Fort Detrick in his present capacity since 1968, and has had extensive experience in Central American countries and Mexico as a consultant on controlling VEE.

The vaccine used to suppress the epidemic had been developed during 18 years of Army research at the Fort Detrick laboratories, part of which recently were converted by President Nixon to a National Cancer Research Center.

VEE, the horse "sleeping sickness" that swept across 25 Texas counties and parts of Mexico this past summer, is a mosquito-borne disease that kills about 50 percent of the unvaccinated horses it infects. More than 90 percent of the horses in 19 states were vaccinated against the disease in the 1971 epidemic control program.

The Army's interest in the virus was first aroused by an epidemic which began in Trinidad in October 1943. That outbreak was alarmingly lethal among horses, donkeys, mules and burros. By 1960, Fort Detrick vi-

rologists successfully applied the experimental data gathered from nearly two decades of VEE research. In 1966 production of the vaccine was begun.

COL Crozier graduated from the University of West Virginia and the Harvard Medical School. A Diplomate of the American Board of Internal Medicine, he has commanded the Army research unit at Fort Detrick since July 1961.

LTC Spertzel has a BA degree in microbiology from the University of Pennsylvania, a VMD from the University of Pennsylvania Veterinary School, an MS in radiobiology

from the University of Rochester (N.Y.), and a PhD in microbiology from Notre Dame University.

Others presented the U.S. Department of Agriculture (USDA) Superior Service Award are: Dr. Richard E. Omohundro, USDA Animal Health Program; George E. Cavin, USDA Plant Protection Program; COL Edward F. Borsare, U.S. Air Force; Dr. James W. Glosser, Department of Health, Education and Welfare; and Joe E. Finley, Texas Animal Health Commission.

The seven individuals singled out for the awards were personally involved in the vaccination of 2.8 million horses and the spraying of more than 12 million acres for mosquito abatement—a program termed "unprecedented in magnitude."

Army Begins Developing Tactical Transport Fleet

(Continued from page 1)

has selected General Electric Co., Lynn, Mass., as prime contractor for development of a new 1500-shaft horsepower turbine engine. This involves a contract of about \$50 million. Funds to support the engine development are included in Army budget forecasts.

Three of eight companies receiving requests from the Army in July 1971 for quotations on the engine development submitted proposals. Besides GE, the bidders were United Aircraft Corp. Pratt and Whitney Aircraft Division and Avco Corp. Lycoming Division.

GE submitted a design proposal based on concepts and technology explored during a previous Army Advanced Technology Engine Program. The Army decided that the proposed engine will involve the least technical risks in meeting the schedule and performance requirements for development and production of the UTTAS.

The Army will ask industry to submit proposals for the UTTAS airframe. Two contractors will be selected for competitive development of the airframe delivered to the Army for competitive test and evaluation.

The three companies that have announced definite interest to compete in the airframe competition are Bell Helicopter Co. of Textron Inc., Boeing's Vertol Division, and United Aircraft's Sikorsky Aircraft Division.

The Army plan calls for the two companies selected to build six helicopters apiece. These will then engage in a thorough competitive flyoff before the Army chooses a single contractor for production.

Deputy Defense Secretary David Packard approved full-scale development of the UTTAS last June, but the Army is taking a deliberate approach to avoid costly technical problems.

While the UTTAS is the newest Army helicopter program, two other major development efforts are under way.

One is the heavy-lift helicopter being developed by Boeing, designed for payloads of up to 22.5 tons. It is now in the component development stage and an engineering development decision is expected to be made in 1975.

The other is the Cheyenne, an attack helicopter now in the advanced engineering development stage at Lockheed Aircraft Corp.

WAC Officer Qualifies As First in Elite Group

(Continued from page 1)

and a Combat Developments Command unit, the Concepts and Force Design Group, AMCA is concerned primarily with development of the Land Combat System for future U.S. land forces.

As the first woman to qualify for the Army R&D Officer Program, MAJ Ramirez joins a highly selective organization filled entirely by volunteers since it was established in 1955. (See July-August 1971 *Army R&D Newsmagazine* feature article, page 20.) Ninety-eight percent of enrollees have a bachelor's degree or higher; 68 percent have master's degrees.

MAJ Ramirez was educated in Mexico and earned a chemical engineering degree from the National Polytechnic Institute in Mexico City. Her first association with the military was as a guest of a military academy riding school in Mexico. She became an expert equestrienne—potential material for the Olympics Games, in the opinion of some observers.

Entry into military service diverted her from such a goal. After being commissioned, she was assigned as a chemical engineer in the Chemical R&D Laboratory, Edgewood (Md.) Arsenal. She also commanded the Edgewood WAC Detachment in 1964. Later she served as a munition production officer, Ammunition Procurement and Supply Agency, Joliet, Ill.

Kawano Selected as Commander, Deputy Director of AMMRC

Commanding officer and deputy director of the Army Materials and Mechanics Research Center (AMMRC), Watertown, Mass., are the new titles of MAJ (Dr.) Kenneth I. Kawano.

During the past year he served in the Materials Systems Branch, G-3 Section, HQ U.S. Army, Vietnam, and later as chemical officer, 1st Brigade, 5th Infantry Division (Mech.) (Sep.). He completed the Command and General Staff College at Fort Leavenworth, Kans., in June 1970.

A native of Kaunakakai, Molokai, Hawaii, he earned a BS degree in chemistry from the Massachusetts Institute of Technology in 1959. Commissioned as an officer in the Chemical Corps, he entered the University of Wisconsin under the Army graduate study program and received a PhD degree in organic chemistry in June 1963.

During the period August 1963 through February 1965, MAJ Kawano served as assistant S-3 at HQ 100th Chemical Group, Fort McClellan, Ala., completed the 18th Chemical Officers' Career Course at the U.S. Army Chemical Center and School (USACCS), and commanded HQ and HQ Company, Troop Command, USACCS.



MAJ Kenneth I. Kawano

After serving in Korea as chemical officer and S-2 of the 2d Infantry Division Artillery, he was assigned as an instructor, then assistant professor of chemistry at the U.S. Military Academy (USMA), West Point, N.Y.

During the summers of 1967 and 1968, while serving at the USMA, he entered the National Science Foundation Program for Research Participation for College Teachers, held at the University of Florida.

His decorations include the Bronze Star Medal with Oak Leaf Cluster, Air Medal, Army Commendation Medal, National Defense Service Medal, Vietnamese Service and Campaign Medals, and the Aircraft Crewman Badge.

Army Group Reviews Environmental Quality Progress, Needs, Problem Areas

In its second conference on the status of Army R&D environmental quality control, Dec. 8-9, the Office of the Chief of Research and Development (OCRD) focused attention on current progress and future requirements.

Expanded to include Navy and Air Force representatives, this year's meeting had as an additional objective the consideration of priority problems.

Presentations, followed by discussions, were made by the Office of the Chief of Engineers (OCE), Army Materiel Command (AMC) agencies, Office of the Surgeon General (OTSG), Life Sciences Division of OCRD, the Navy and the Air Force.

Each brought out current and proposed projects and identified problem areas. Through this exchange, participating agencies were apprised of the work being done by others.

Acting Director of Army Research COL N. R. Rosen opened the sessions by stating that much has been accomplished since last year's conference. He cited as examples the formulation of programs, better identification of pollution control and abatement requirements and activities, and development of estimates of essential funding support.

"The necessary expansion of the over-all program is well under way," he said, "and sizable monies are being budgeted in support of this effort."

This is evident in the funding increase for pollution abatement, which for AMC alone will soar to \$7,670,000 in FY 73 from the FY 71 amount of \$495,000. Similarly, OCE and OTSG funding will go up in FY 73 to \$4,600,000 and \$1,617,000, respectively, from a total of \$2,810,000 for both agencies in FY 71.

Examples of the pollution abatement work being done were perhaps typified in the presentation by AMC's Coating and Chemical Laboratory at Aberdeen Proving Ground, Md.

This agency of the Aberdeen Research and Development Center reported on the close liaison that has been established with producers of electrocoating materials to permit their

use on military items as a means of minimizing pollution from solvent systems.

Other efforts there involve zinc phosphating processes that have been revised and approved for production of ammunition and automotive materiel to eliminate fluoride materials, with no reduction in performance; replacements for chromic acid rinses on a selective basis pending development of replacement materials; and conversion of all heavy-duty industrial cleaners and paint stripping compounds to formulas utilizing 80 percent biodegradable detergents without loss in overall efficiency.

Many more processes, techniques, and conversions were reported by representatives of other agencies, indicating the extent to which all Army and other service agencies are gearing environmental quality efforts.

Conferees were reminded by COL Rosen "that duplication of effort must be avoided and maximum coordination between develop-

ing agencies be accomplished."

MG George Sammet Jr., Deputy Chief of Research and Development, in his letter of invitation to participating agencies, stated that one of the purposes of the conference was "to permit mutual exchange of ideas, information and possible support."

More than 50 participants included CPT William F. Reed, Jr., Oceanographer of the Navy; CPT A. G. Luskin, assistant to the Secretary of the Navy; CDR P. A. Petzrick, Naval Materiel Command; A. Wayne Magnitzky, Office of the Chief of Naval Operations; COL Herbert E. Bell, Office of the Assistant Secretary of Defense; MAJ Donald G. Silva, U.S. Air Force; Chief Scientist Gilford G. Quarles and Robert F. Jackson, Office of the Chief of Engineers, Army; LTC Robert M. Shaw Jr., Office of the Surgeon General, Army; COL Donald L. Howie, chief, Life Sciences Division, OCRD; and Edward B. Trecott, AMC.

AMMRC Opens Scientist Exchanges in TTCP Program

Under the auspices of The Technical Cooperation Program (TTCP), the U.S. Army Materials and Mechanics Research Center, Watertown, Mass., has effected USAMMRC's first exchange of U.S. and foreign scientists engaged primarily in materials research.

Dr. Michael Lindley of the Admiralty Materials Laboratory (AML), Holton Heath, Dorset, England recently completed a 90-day tour of duty to study boron carbide as a lightweight armor material. Dr. Donald R. Messier of the Ceramics Division, AMMRC, worked 90 days at AML studying silicon nitride as a potential material for high-temperature aircraft engine components.

TTCP was initiated in October 1957 as a result of discussions held by the President of the United States and the Prime Minister of the United Kingdom. These discussions stressed the need for an "enlarged Atlantic effort in scientific R&D in support of greater collective security."

Canada was later invited to participate in

implementing a declaration of military research and development. In 1965 Australia, and more recently New Zealand, accepted invitations to participate.

The over-all objective of TTCP is the identification and recommendation of planned cooperation in projects and programs which will improve the utilization of the combined technical resources and capabilities of the participating countries.

Several subgroups have been formed by the participating nations for the exchange of personnel, information and material. The subgroup on Materials is comprised of four panels: (1) Metals, (2) Inorganic Non-Metallic Materials, (3) Organic Materials, and (4) Evaluation Methods for Materials and Materials in Structures. The Army Materials and Mechanics Research Center has representation on all four panels.

Panel 2 effected the exchange of scientists Drs. Lindley and Messier.

IDA President Appointed As Chairman of DIASAC

Dr. Alexander H. Flax, president of the Institute for Defense Analysis, is the new chairman of the Defense Intelligence Agency Scientific Advisory Committee (DIASAC).

Defense Intelligence Director LTG Donald V. Bennett announced his selection to succeed Dr. Albert C. Hall. A member since 1967, the past two years as chairman, Dr. Hall was recently appointed first Assistant Secretary of Defense for Intelligence.

Dr. Flax was chief scientist of the U.S. Air Force (1959-61) and during 1963-69 was Assistant Secretary of the Air Force for Research and Development. He has been a member of the DIASAC since 1970.

The committee of prominent government and industrial scientists and engineers advises the DIA director on mission-related scientific and technical matters.

Honored with the General Thomas D. White Trophy in 1966, among a number of other awards for outstanding service, Dr. Flax is known for numerous technical publications on aerodynamics.



TECHNICAL COOPERATION PROGRAM exchange scientists Dr. Michael Lindley (center) and Dr. Donald R. Messier (right) met recently in the office of Dr. Alvin E. Gorum (second from right), director of the Army Materials and Mechanics Research Center (AMMRC), Watertown, Mass. Also shown (from left) are Robert N. Katz, chief, Ceramics Div., and Irving Berman, deputy chief, Development and Engineering Lab.

Picatinny Arsenal Solves Rocket-Assisted Projectile Problems

Standardization of the U.S. Army's first operational cannon-launched Rocket Assisted Projectiles (RAP) has established the 155mm M549 and the 105mm M548 as forerunners of projectiles envisioned as revolutionizing artillery technology and tactics.

These are the world's first fully zoned RAPs suitable for use at temperatures ranging from Arctic cold to desert heat.

The M549 RAP was standardized for use in the 155mm SPH, M109 in October 1971 and the M548 went into limited production and release in 1970. Both rounds were developed by the Solid Rocket Propulsion Laboratory (SRPL) of the Ammunition Development and Engineering Directorate, Picatinny Arsenal, Dover, N.J.

Combining the latest advances in rocket, metallurgical and aeroballistic technologies, these RAPs enable existing weapons to achieve one-third more range and twice the payload effectiveness of conventional World War II projectiles.

Standardization of these RAPs opens the way for development of many new lightweight, highly mobile, extended-range weapons, ranging from shoulder-fired to helicopter-mounted systems. Each round will weigh no more than the conventional round it replaces.

Field artillery cannon, noted for precision, operational simplicity and flexibility, are necessarily heavy to accommodate the reaction loads. Rocket-firing weapons may be lightweight because they can use open-tube launchers that produce little reaction to the mount.

The back-blast from open-tube launchers, however, has proved objectionable and the accuracy of rocket fire has not compared favorably to that of artillery fire.

All major nations, starting with Germany

ROCKET ASSISTED PROJECTILE

GIVING 1/3 RANGE INCREASE



before World War II, have attempted to combine the advantages of artillery and rockets in one round, but have been unsuccessful in overcoming the technical problems.

The tremendous shock and spin loads imposed when launching rockets from cannons are 400 times greater than in the average rocket and about 10 times greater than in the most highly stressed small rockets used today.

These forces are particularly troublesome at extreme temperatures, corresponding to arctic or tropic environments in which all Army tactical ammunition is required to be functional.

Propellants are brittle as glass at low temperatures, soft and pliable at high temperatures. In addition, their burning characteristics are so seriously affected by the high-spin rates necessary for spin stabilization that ordi-

nary rocket interior ballistic design technology is not applicable.

Severe design problems are posed by the requirement for full-range zoning and achievement of typical artillery accuracy and precision.

(This means that the round must accurately impact at any selected point, from close to the launcher to the maximum range, with the launcher pointed at any selected elevation from horizontal to near vertical to permit firing over obstacles.)

The projectile must remain stable throughout flight, even when launched at very high angles and at a wide variety of launch velocities. When fired at high angles, the projectile must change its direction from upward to downward at apogee, without becoming unstable and tumbling end over end with re-



SOLID ROCKET PROPULSION Laboratory members who contributed to development of rocket-assisted projectiles at Picatinny Arsenal include (from left) John Smolnik, Joseph Guerra, Saul Wasserman, Fred Menke, Emil Merz, Arthur LoPresti

(chief, Rocket-Assisted Projectile and Pyrotechnics Branch, Ammunition Development and Engineering Directorate), Richard Botticelli, Curtis Anderson, Arnold Novak, Steve Harnett and William Moscatiello. RAPS increase the payload, range.

sultant loss in range and accuracy.

Prevention of this instability at all conditions of launch velocity, air density and temperature poses particularly difficult aeroballistic and rocket thrust programing design problems.

All U.S. efforts to develop zoned RAPs up until the early 1960s involved special low-pressure cannon to minimize the stresses acting on the round during launch. Still the RAPs developed could only be fired over narrow temperature limits and had very poor reliability.

In addition, they had poor accuracy, low payload capacity per pound of ammunition and could not be fired at all ranges because they became unstable at high firing angles.

These major deficiencies led to U.S. Army disenchantment with RAPs and cancellation of all development programs.

Picatinny Arsenal's Solid Rocket Propulsion Laboratory was assigned the task of making a final assessment of the prospects of overcoming inherent technical problems of zoned rocket-assisted projectiles—prior to relegating the project to R&D oblivion.

This action marked the first time Picatinny Arsenal carried complete responsibility for zoned RAPs. The SRP Laboratory is staffed with engineers and scientists having broad experience and background in propulsion, aerodynamics, mechanical engineering, mathematics, fabrication technology and design drafting for rockets and artillery ammunition.

This versatile and broad-ranging scientific and engineering capability permits rapid resolution of both theoretical and practical interface problems, investigators report.

Within two years, the laboratory reported major advances in RAP performance. Accuracy was improved 100 percent, propulsion efficiency 25 percent and payload per pound of ammunition 50 percent. Full zoning over the entire range at all firing elevations was achieved, reliability vastly increased, and firing temperature limits greatly expanded.

The new technology was demonstrated successfully in RAPs fired from the previously used low-pressure cannon, which had been specially designed to soften the firing stresses. It also was applied to standard high-pressure cannons with their very high acceleration and spin stresses.

Because of the Army's previous disappointing experience with RAPs, skepticism was widespread. To gain acceptance and recognition of the performance and potential of the new RAP technology, key personnel of the Solid Rocket Propulsion Laboratory gave numerous briefings at all Army levels. They also published and presented technical papers before many national and international technical societies and groups.

In addition, several firing demonstrations were conducted for Army, Marine and NATO observers at temperate, desert and arctic sites. Subsequently, the Army approved full-scale development programs to develop zoned RAPs for the 105 and 155mm howitzers.

In the meantime, as early information on the technological advances made by Picatinny in RAP performance spread through the technical community, the Navy initiated programs to develop RAPs for shipboard guns, eventually employing much of the technology developed at Picatinny Arsenal. These RAPs are not required to be fully zoned or to

be operational over as broad temperature extremes as the Army RAPs.

The Army Ballistic Research Laboratory at Aberdeen Proving Ground, Md., and Canada's McGill University jointly funded a study by Picatinny on the potential of RAPs in Project HARP (High Altitude Research Project).

The study showed that RAPs launched from 16-inch guns could be used to deliver meteorological and scientific payloads to very high altitudes, corresponding to those previously achieved with large rockets costing many times more per mission.

RAPs, it was found, give much greater accuracy and the spent rounds fall within a much smaller area, thereby, decreasing size of the launching and recovery area required.

Subsequently, Picatinny furnished rocket motors for use by McGill University in their first successful firing of a RAP from a 16-inch gun at a Barbados, West Indies, HARP firing.

Now that the 105 and 155mm RAPs are standard, the Solid Rocket Propulsion Laboratory is developing RAPs for use in other existing weapons; also, for new lightweight extended-range weapons systems being designed and developed specifically to take full advantage of the latest RAP technology.

The laboratory also has developed a wide variety of other rocket propulsion systems. These include aircraft jet-assisted take-off systems, aircraft seat ejection rockets, pilot escape capsule rockets and rocket boosters for reconnaissance drones; also, propulsion systems for numerous guided and unguided missiles, and a wide variety of special propulsion systems for devices such as small turbine generators, emergency raft inflators, aircraft engine starters, aircraft fire extinguishing pressurizers, etc.

All design and engineering, including propellant formulations, thermochemistry, stress analysis, design layout, fabrication methods engineering, aerodynamics, exterior ballistics, trajectory analysis and preparation of design drawings, are done completely in-house by the Solid Rocket Propulsion Laboratory.

Fabrication of propellants and experimental metal parts, as well as all static testing, is done within other arsenal facilities under the technical supervision of design engineers.

In a recent arsenal reorganization, the pyrotechnic design mission was added to the laboratory's responsibilities and it was renamed the Rocket Assisted Projectile and Pyrotechnics Branch.

Computer System Monitors Air Traffic Over WSMR

Airborne traffic over White Sands (N. Mex.) Missile Range is being controlled by a newly installed computerized air surveillance system.

Designed to maintain air safety by monitoring all aircraft flying over or near the range, the system provides almost instantaneous information on their location. As many as 80 aircraft can be monitored simultaneously.

The system also is used to assist in pointing range sensor instruments for initial location of aircraft in test operations. Three-dimensional radars automatically furnish target altitude, distance and direction.

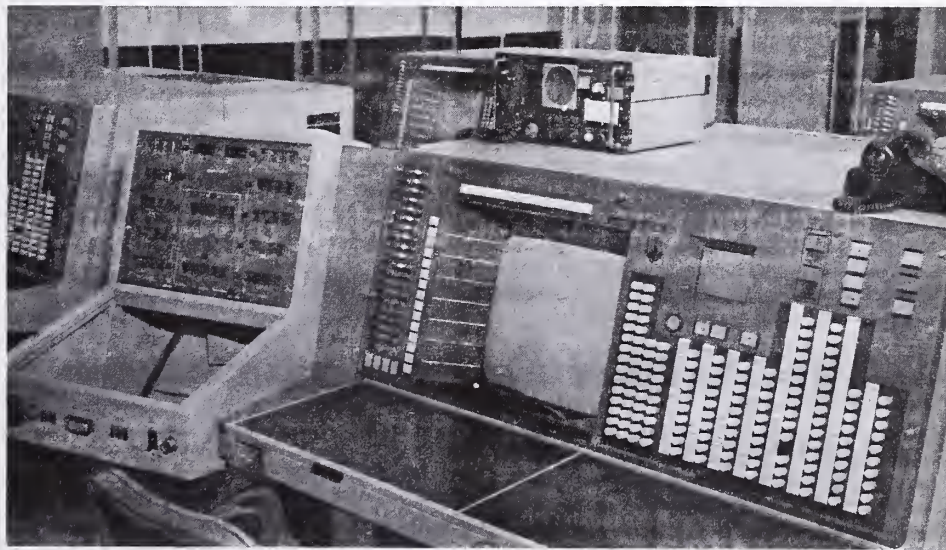
Military and civilian air traffic in areas near WSMR and in offrange test corridors is frequently heavy. For security and safety reasons, it is essential to locate and, when neces-

sary, interrogate these aircraft, particularly during countdown in missile operations which may have to be delayed or postponed because of the intrusion.

Navigational charts show that the airspace above WSMR is restricted. Civilian aircraft occasionally intrude on the 4,000-square-mile range, due mainly to weather, lack of proper navigational equipment, poor navigation and poor flight planning.

The Range Operations Office, an element of the Air Force Special Weapons Center at Kirtland AFB, acts as WSMR executive agent for control of restricted airspace over the range. The control point for the new air surveillance system is located at Holloman AFB and is supervised by LTC Paul E. Smathers, chief of mission control.

The equipment is operated by RCA Service Co. contract personnel.



DATA DISPLAY and control console used for detection, identification and surveillance of airborne traffic over White Sands Missile Range, N. Mex., can handle 80 aircraft.

Picatinny Opens Holography Laboratory For Materials Deterioration Research

Completion of a new holography facility for research activities was announced by Picatinny Arsenal, Dover, N.J., in November, the day after Dr. Dennis Gabor received the Nobel Prize for inventing this lensless 3-dimensional photographic technique.

Dr. Gabor described the principles of the technique in 1948 but its possibilities for application to numerous important military requirements did not excite attention until 1960 when another far-reaching technological advance—the laser beam—pointed to the combined use potential.

Picatinny Arsenal's holography facility was developed largely by Paul Kisatsky and Modesto Barbarisi, physicists in the Physical Research Branch, Engineering Sciences Division, Feltman Research Labs.

Holographic photography, with its 3-dimensional image, provides a means of recording the whole of an object or scene—rather than a flat image of conventional photography.

Producing a hologram involves illumination of an object through the use of intersecting laser beams. Illuminating an object through the use of one laser beam and allowing a second, called the reference beam, to interfere, creates a speckly grain-like pattern of waves.

This interference pattern, as it is known, is then recorded on a photographic plate. The resulting hologram of the object records, in a carefully coded pattern, all information necessary for accurate reproduction (as faithfully as cast mold structure) of a 3-dimensional photograph.

The photograph is produced simply by shining a laser beam through the hologram. By looking into the hologram, a precise replica of the original object can be viewed.

A hologram has some fascinating properties. If cut in two, or smashed into hundreds of pieces, each piece contains the whole scene.

To Picatinny researchers, however, holography is far more than a novelty. It is the basis of a very powerful laboratory diagnostic technique which is finding applications in the Army's nondestructive test program. Since the hologram records a precise master image of some object, this master can then be used to compare the object with itself at some later time, say, after the object has been stressed.

If the object changes or moves by as little as a few micro-inches the object becomes covered with "interference fringes." These fringes can map the exact nature of the change in the object and are analogous to contour lines as seen on a terrain map.

Such small surface changes are normally invisible and can be brought about by almost any physical stimulus. Simple finger pressure

on a several ton granite slab can be seen as the finger depresses the granite!

The growth of a bean plant can be seen in a few seconds of growing time!

A footprint can be seen on a linoleum floor for hours after it was made as the floor depression gradually creeps back to its original state!

These and many more examples can be given to attest to the exciting possibilities of holography.

In the last few months Kisatsky and Barbarisi have only begun to explore the world of holography. In one particular application, they will be searching for a means to detect subtle deteriorations in the surfaces of engineering materials leading to advance warning that fatigue or corrosion in structural components is taking place.

As an overworked piece of metal approaches fatigue, subtle changes in surface condition occur that are not easily detectable.



PICATINNY ARSENAL physicist Modesto Barbarisi adjusts position of hologram during experiments to improve reproduction of 3-dimensional photographs by use of a laser beam.

However, they show up in a holographic comparison of the unfatigued with the fatigued part.

Gradual surface changes occurring in corrosion give short term indicators that the forces of corrosion are at work. Corrosion tests are sometimes long and time-consuming. Using holography to observe these effects in their early stages can result in considerable time and cost savings in testing.

Inventor Dr. Gabor believes holography may lead to medical examinations that are superior to X-ray, and also 3-dimensional movies and television.

Picatinny Sets Up Directorate To Improve Munitions Process

The Manufacturing Technology Directorate (MTD), assigned with the responsibility for all phases of process engineering related to the manufacturing of munitions, is a recent addition to the organization of Picatinny Arsenal, Dover, N.J.

Leon Saffian, former deputy chief of the Munitions Engineering Division of the Ammunition Engineering Directorate, is the MTD acting director. It has three divisions: Administrative, headed by Donald Fischer; Advanced Process Technology, Stanley Wachtell; Automation and Pollution Abatement, Irving Forsten.

The MTD is concerned with modernization and advanced technology needs for the manufacture of propellants and explosives (including pyrotechnics); loading propellants and explosives into munitions; assembling, handling, and packing of munitions; establishment of protective design criteria for operational and storage facilities; control of environmental contamination; and computerized process-control techniques.

REDESIGN OF PACKAGING for M213 hand grenade fuzes by three Picatinny (Dover, N.J.) Arsenal employees has resulted in a FY 71 savings of \$504,100 and an estimated 3-year total of \$1,545,700. Prior to the value engineering change, 240 fuzes were packaged in polystyrene supports and overpacked with a nailed wooden box. This required removal of each fuze for X-ray. Now 360 fuzes are packaged in polystyrene supports and overpacked with a wire-bound box, permitting the fuzes to be X-rayed in the pack. The new packaging is shown at right, along with developers (from left) James Spilman, Henry Grezlakosky and Charles Banta, all with the Munitions Packaging Branch of the Ammunition D&E Directorate.



9 Army Agencies Sharing in Presidential Program of S&E Internships Under NSF

Nine U.S. Army facilities are among the first two groups of government and private agencies selected recently to participate in a new program of Presidential Internships in Science and Engineering.

Of 420 one-year internships in federal or federally funded laboratories opening up under this program, 30 are being awarded on the first two of three lists to Army facilities involved in research and development activities. A third list scheduled for early release will announce additional Army facilities granted awards.

Funded by \$3 million from the Department of Labor, the new program is being administered by the National Science Foundation (NSF), which has made the internship awards in three increments.

The program permits engineers and scientists to apply directly to agencies for the one-year nonrenewable internships. Each award provides a stipend of \$7,000 per year, which may be supplemented by the installation concerned.

Internships will broaden the work experience of the engineers and scientists and are expected to facilitate their transition to future jobs. Individuals are being recruited in whatever manner is normally used by the agency, subject to NSF guidelines, but veterans and those from high unemployment areas are receiving preference.

Appointments will be made only to young unemployed scientists or engineers holding advanced degrees (master's or higher) whose qualifications and promise are superior.

Dr. Edward E. David Jr., Science Adviser to the President, said: "We would hope to expose the trainees to both the problems and the capabilities of government research and development and put them in positions where they can best benefit the nation and themselves."

Labor Secretary J. D. Hodgson, whose department is funding the effort from its Technology Mobilization and Reemployment Program, said, "The internships greatly strengthen the nation's effort to hold onto its pool of trained scientists and engineers."

David, whose Office of Science and Technology developed the program, pointed out that "these people provide a unique pool of skills and resources, much of it developed at taxpayers' expense in colleges, universities and various laboratories. They represent a vital national resource."

He mentioned that the internships should be particularly beneficial for unemployed younger scientists and engineers who hold advanced degrees. Those under 30 are among the hardest hit by the current job squeeze; they have an unemployment rate of 5.3 percent, according to a recent National Science Foundation survey.

David also noted that the fields in which they would have the greatest impact are those of current social concern, including pollution control and abatement and trash disposal. Other areas are management and integration of large projects, and the nuclear field in areas as diverse as new power systems or criminal and medical laboratories where nuclear techniques are contributing greatly.

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Individuals interested in the program have been instructed to apply directly to a laboratory or one of the offices of the Technical Mobilization and Reemployment Program (TMRP).

Army facilities participating (as announced on the October and November lists) are: Tank-Automotive Command Laboratories, Warren, Mich.; Cold Regions Research and Engineering Laboratory, Hanover, N.H.; Human Resources Research Organization, Alexandria, Va.; HQ Army Missile Command, Redstone Arsenal, Ala.; Harry Diamond Laboratories, Washington, D.C.; HQ Army Weapons Command, Rock Island, Ill.; Army Land Warfare Laboratory, Aberdeen Proving Ground, Md.; Picatinny Arsenal,

Dover, N.J.; and Army Mobility Equipment R&D Center, Fort Belvoir, Va.

Service offices of TMRP are located in: Huntsville, Ala., Los Angeles-Long Beach, Orange County, San Diego, and San Jose, Calif.; Cape Kennedy, Fla.; Atlanta, Ga.; Wichita, Kans.; Boston, Mass.; St. Louis, Mo.; Long Island (Nassau and Suffolk Counties), N.Y.; Philadelphia, Pa.; Camden, N.J.; Dallas-Fort Worth, Tex.; and Seattle, Wash.

Exact addresses of these offices are available on request from the Manpower Administration of the Department of Labor.

Inquiries concerning this program are also being directed to: Division of Graduate Education in Science, National Science Foundation, Washington, D.C. 20550.

Jones Becomes CO, Technical Director of USARIEM

Command of the U.S. Army Research Institute of Environmental Medicine, with additional duty as scientific-technical director, is the new responsibility of COL LeeRoy G. Jones, MD, formerly director of the USARIEM Medical Laboratory.

COL Jones served in the latter capacity until he became a student at the Army Command and General Staff College, Fort Leavenworth, Kans., graduating this year as class president.

In 1967 he served as chief, U.S. Army Medical Research Team in Vietnam. Other recent assignments have included a tour of duty at HQ U.S. Army Mobility Equipment R&D Center, Fort Belvoir, Va., Walter Reed Army Institute of Research, Washington, D.C., and the Medical Field Service School.



COL LeeRoy G. Jones

A graduate of Michigan State College, he received his MD degree from Wayne University College of Medicine in 1956. Following his internship at Holy Cross Hospital in Salt Lake City, he completed his residency in internal medicine, under Army sponsorship, at the City of Detroit Receiving Hospital in 1961. During 1965-67 he was a postdoctoral research Fellow in physiology at Harvard Medical School.

The author of numerous scientific articles, COL Jones is a member of the American Medical Association, American Federation for Clinical Research, American Physiological Society, Association of Military Surgeons of the United States and a Fellow of the American College of Physicians.

Infantry Board Tests Night Vision Infrared Television for Training

Without any visible lighting to probe the darkness of the night, the interaction of men and equipment under simulated combat conditions was observed in recent U.S. Infantry Board tests at Fort Benning, Ga.

This feat was accomplished with a TV test camera fitted with a silicon diode videon tube and infrared light sources, developed by the Army Night Vision Laboratories, Fort Belvoir, Va., for perimeter TV surveillance.

The system also enabled test officers to record the action on video tape for later instant replay and study.

This principle of recording also is being studied in Project MASSTER at Savannah, Ill., and Fort Hood, Tex., where TV cameras are used by perimeter guards for security and surveillance.

Soldiers performing combat tasks under view of the new cameras can review their actions, which heightens interest in the tasks performed and provides an immediate feedback on difficulties encountered. Questions concerning problems that develop in tactical

situations can be answered by the test participants during the review.



TV TEST CAMERA, fitted with silicon diode videon tube and infrared light sources, was used to view simulated combat conditions at Fort Benning, Georgia.

Edgewood Aerodynamic Research Directed to Advanced Weapons Systems

Advanced aerodynamics concepts are being explored in futuristic weapon systems development by the Physical Research Division, Chemical Laboratory at the U.S. Army Edgewood (Md.) Arsenal.

The Aerodynamic Research Branch, headed by Abraham Flatau, has conceived and developed various weapon systems, ranging from conventional shoulder-launched grenades to mines, bomblets, rockets, flare-parachute configurations, and airborne riot-control-agent dispensers.

"Currently we are placing major emphasis on the exploratory development of a ring air-foil grenade (RAG), a projectile possessing a far greater range than any grenade presently in use," Flatau said. "Although not a new concept in aerodynamics, RAG is unique in weaponry. It is shaped like a doughnut and can be fired in an arching or flat trajectory."

(The July-August 1971 edition of the *Army R&D Newsmagazine*, page 12, reports on early feasibility studies of RAG by the U.S. Army Small Arms Systems Agency, Aberdeen Proving Ground, Md. The report includes information on design and development of prototype primer hardware and a launcher by Frankford Arsenal, Pa., and Watervliet, N.Y., Arsenal.)

Personnel in the Aerodynamics Research Branch have also designed and developed several types of small auto-rotor bomblets, which glide to a target and disperse over a large area.

"Because of their shape, they assume a spinning motion as they fall," Flatau explained. "The spinning action creates an aerodynamic force similar to that which causes a baseball to curve. Rather than falling like a rock, the auto-rotor tends to glide."

Edgewood's 10-man aerodynamic team also has developed a Ram Air-Inflatable Decelerator (RAID), designed for dropping highly sensitive sensors at strategic points from high-speed aircraft flying at extremely low altitudes.

RAID consists of a containerized nylon bag folded and shaped like a parachute. When ejected from the fuselage of a high-speed aircraft, the bag is inflated by the airflow.

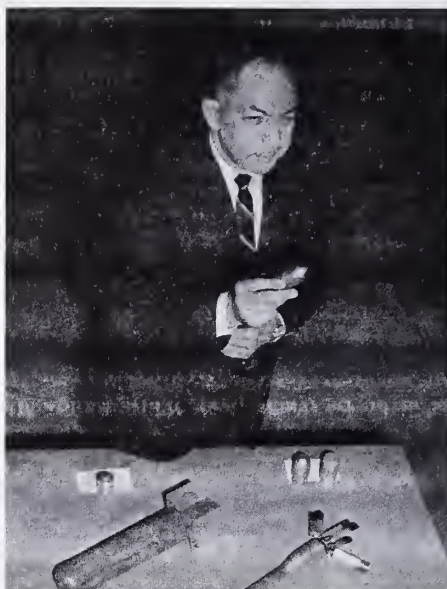
RAID flight tests were conducted at Eglin Air Force Base, Fla., before the sensors were considered for deployment to Southeast Asia.

"The aerodynamic design had to slow down the drop of the 40-pound sensor from the 700-mph speed of the aircraft at release to a velocity low enough to survive impact with the ground," Miles Miller, another Edgewood aerospace engineer, explained.

The RAID system represents a totally new approach in the deceleration field and its potential uses can be extended to a variety of air delivery items, Miller said.

Research aerospace engineer, Donald N. Olson, termed development of the sensor delivery system a typical example of the capability of the Aerodynamic Research Branch to tackle unusual projects requiring relatively rapid solutions.

He praised the ability, dedication and motivation of the lab's six aerospace engineering



Abraham Flatau

technicians—Richard R. Raup, Norman F. Singleton, Dell A. Crouch, Owen C. Smith, Frank G. Wrede and John W. Molaar.

Joseph Huerta, a specialist in transonic and supersonic aerodynamics, described the wind tunnel as the heart of aerodynamic research.

The Aerodynamic Research Branch has five wind tunnels ranging from a 6 × 6-inch supersonic version to a 20 × 20-inch transonic tunnel, considered to be the Army's largest and most modern facility in this Mach number range.

The latter is a blow-down type with a Mach range of 0.47 to 1.3. It has an air storage capacity of 6,000 cubic feet at 175 pounds per square inch and is capable of running tests from 10 to 20 seconds, depending upon Mach number and stagnation pressure.

Flatau said the branch has the capability and equipment needed to handle practically any aerodynamic research requirement—from conception or original design, through model or prototype fabrication, wind tunnel experimentation analysis, evaluation and simulation, and flight testing of the finished product.

Brown Succeeds Izenour as TECOM Commander

Retirement of MG Frank M. Izenour Nov. 30 set the stage for MG Charles P. Brown to succeed him as commanding general, U.S. Army Test and Evaluation Command (TECOM), headquartered at Aberdeen Proving Ground, Md.

Dignitaries at change-of-command ceremonies Dec. 1 included MG Charles T. Horner Jr., Army Materiel Command chief of staff; MG John R. Guthrie, AMC deputy CG for Materiel Acquisition; BG Samuel W. Koster, deputy CG and chief of staff, TECOM; BG Max Etkin, CG, Desert Test Center; and COL Warren D. Hodges, CO, Aberdeen Proving Ground.

MG Brown came to his new assignment, making him responsible for 15 TECOM activities and installations, after serving as military adviser to President Nixon's personal representative at the United States-Vietnam peace negotiations in Paris, France. He also has served a tour of duty with the North Atlantic Treaty Organization (NATO).

While assigned to HQ Department of the Army in Washington, D.C., he held a number of progressively responsible positions. His career in recent years includes a tour of duty as commanding general of the Field Artillery Center at Fort Sill, Okla. During World War II he served in the Asiatic-Pacific theater.



COLORS SALUTE is offered by MG Charles P. Brown (right) during ceremonies honoring his assumption of command of the U.S. Army Test and Evaluation Command. Accompanying him are 1LT Michael R. Jamison, honor guard commander, and BG Samuel W. Koster, TECOM deputy commanding general and chief of staff.

GIDEP Convenes First Workshop, Estimates \$5 Million Cost Cuts

The Government-Industry Data Exchange Program (GIDEP), established by the Joint Commanders Agreement of October 1970, drew 122 persons to its first workshop, Nov. 9 and 10, in San Francisco, Calif.

Successor to the Interagency Data Exchange Program (IDEP), the GIDEP is a cooperative activity between government and industry participants seeking to reduce or eliminate duplication of effort.

By exchanging data on components, parts, materials and processes, representatives of government and industry help to save taxpayers' dollars. Already the program has resulted in estimates of an annual cost savings of over \$5 million.

Through the GIDEP, duplicative test expenditures for parts and components entering the government inventory are cut down or, in some instances, eliminated. Another important facet of the GIDEP is the interchange of test equipment calibration procedures.

The workshop enabled participants to learn about the GIDEP and how to make effective use of its data bank. Attendees also discussed specific problems they had encountered. In many cases, potential solutions were offered.

In addition to the workshop sessions, attendees were addressed by three outstanding speakers. General Ben I. Funk (USAF, Ret.) who was instrumental in starting the IDEP, was the keynote speaker.

Dr. John Condon, director of Quality Assurance, National Aeronautics and Space Administration (NASA) was the luncheon speaker, and BG Mahlon Gates, Army Materiel Command Deputy Director of Research, Development and Engineering, was the dinner speaker.

Dr. Condon urged participants to accept the challenge of looking for additional ways to improve the interchange of data to reduce R&D costs, and improve the reliability of systems.

General Gates discussed ways the GIDEP interfaces with other data exchange activities in AMC. He stressed the importance of using good management techniques and controls to ensure the best weapons system possible for the Army's R&D dollars.

Program director of the GIDEP is CDR Albert A. McPherson, HQ Naval Materiel Command. Since January 1971 he has been assisted by a government advisory group and one from industry in establishing new policies and procedures to strengthen and energize the program.

The Army portion of the GIDEP is assigned to MG Stuart C. Meyer, Director of Research, Development and Engineering, AMC, and is managed by AMC's Technical Data/Standardization Branch headed by Steve Stoll. Edward Hargis, assigned to this branch, is the Army Member of GIDEP and chairman of the Government Advisory Group.

In addition to Army participants, the 2-day workshop was attended by representatives of the Navy, Air Force, Defense Documentation Center, NASA, the Canadian Army Military Electronics Standardization Agency, and U.S. and Canadian industries.

Scientific Calendar

4th Annual Microprogramming Workshop, sponsored by ACM, Las Cruces, N. Mex., Jan. 6-7.

Gordon Research Conference on Electrochemistry, sponsored by ARO-D and AFOSR, Santa Barbara, Calif., Jan. 10-14.

1972 Hawaii International Conference on System Sciences (HICSS-5), sponsored by ARO-D, NSF and University of Hawaii, Honolulu, Hawaii, Jan. 11-13.

Reliability Symposium, sponsored by IEEE, San Diego, Calif., Jan. 25-27.

Winter Power Meeting, sponsored by IEEE, N.Y.C., Jan. 30-Feb. 4.

1972 International Symposium on Information Theory, sponsored by ARO-D, ONR and NSF, Asilomar, Calif., Jan. 31-Feb. 4.

Meeting on Information Theory, sponsored by IEEE, Pacific Grove, Calif., Jan. 31-Feb. 4.

Engineering Applications of Holography Symposium, sponsored by TRW Systems, Anaheim, Calif., Feb. 16-17.

International Solid State Circuits Conference, sponsored by IEEE, Philadelphia, Pa., Feb. 16-18.

Tri-Service Human Factors Test and Evaluation Conference (TESCON-IV), sponsored by OCRD, AMC, Air Force and Navy, Orlando, Fla., Feb. 29-Mar. 2.



ARMY ATTENDEES AT GIDEP Workshop. First row (from left): Steve Stall, U.S. Army Materiel Command (AMC) HQ; BG Mahlon Gates, deputy director of RD&E, AMC; Edward Hargis, AMC HQ. Second row: Charles Reynolds, U.S. Army Aviation Systems Command (AVSCOM), St. Louis, Mo.; Ismael Haznedare, Picatinny Arsenal, Dover, N.J.; Donald Varocek, U.S. Army Weapons Command (WECOM), Rock Island Arsenal, Ill. Third row: C. Banton, U.S. Army Tank-Automotive Command (TACOM), Warren, Mich.; Miss Grace Marseglia, U.S. Army Electronics Command, Fort Monmouth, N.J.; Joseph Marvick, Harry Diamond Laboratories, Washington, D.C.; Maurice Taylor, Frankford (Pa.) Arsenal. Fourth row: Russell Wise, U.S. Army Combat Developments Command Maintenance Agency, Aberdeen Proving Ground, Md.; Roland Guard, U.S. Army Missile Command (MICOM), Redstone Arsenal, Ala. Fifth row: D. M. Lervandowski, TACOM; Leslie Conger, MICOM; Dale Dugal, MICOM. Army attendees not shown include Howard Strayer, U.S. Army Depot, Sacramento, Calif.; Ralph Armbruster, U.S. Army Mobility Equipment R&D Command, Fort Belvoir, Va.; and Harold Dunkel, AVSCOM.



ADVANCE PLANNING BRIEFING for industry brought together more than 400 persons from government and industry at HQ U.S. Army Electronics Command (ECOM), Fort Monmouth, N.J. Among Army commanders and industrial executives attending were (from left) GEN Henry A. Miley Jr., CG of the Army Materiel Command; MG William K. Ghormley (USA, Ret.), executive vice president, American Ordnance Association; and MG Hugh F. Foster Jr., CG of ECOM. The 2-day meeting was sponsored by the Army Weapons Command, Army Munitions Command, American Ordnance Association, and National Security Industrial Association.

SENSORS . . .

Surveillance in Combat

Since armies first took to the field for combat, the detection and location of enemy forces has been a formidable and challenging task. History is replete with battles that were lost because an unsuspecting commander let the enemy surprise him or slip from his grasp.

During World War II, although major advances had been made in mobility and firepower, U.S. Forces still lacked the ability to find the enemy.

This was demonstrated convincingly during the Battle of the Bulge in December 1944 when the Germans successfully increased their forces from nine to 26 divisions in six days, moving under cover of darkness. Little was known of their buildup even though U.S. air reconnaissance had flown 3,000 sorties on three of the six days.

As the early history of the war in Vietnam clearly demonstrated, there were few improvements in surveillance capabilities following World War II. The unprecedented magnitude of this detection of the enemy problem in Vietnam prompted consideration by a scientific group known as the Jason Committee.

Former Secretary of Defense Robert S. McNamara, in mid-1966, received the committee's proposal of a concept for inhibiting enemy troop and supply infiltration into South Vietnam by means of an air-supported barrier system, supplemented by a conventional barrier system.

These systems called for the use of electronic sensors to detect enemy personnel and vehicles, and the use of tactical aircraft, mines and other munitions to counter the detected enemy incursions.

In September 1966, the Defense Communications Planning Group (DCPG), forerunner of today's Defense Special Project Group (DSPG), was established.

Initially, its mission was to put into operation a military concept that was to become loosely known as the McNamara Wall. This concept included an air-supported anti-vehicular and anti-personnel system in Laos, collectively referred to as "Igloo White," and a fixed conventional barrier system across the demilitarized zone (DMZ).

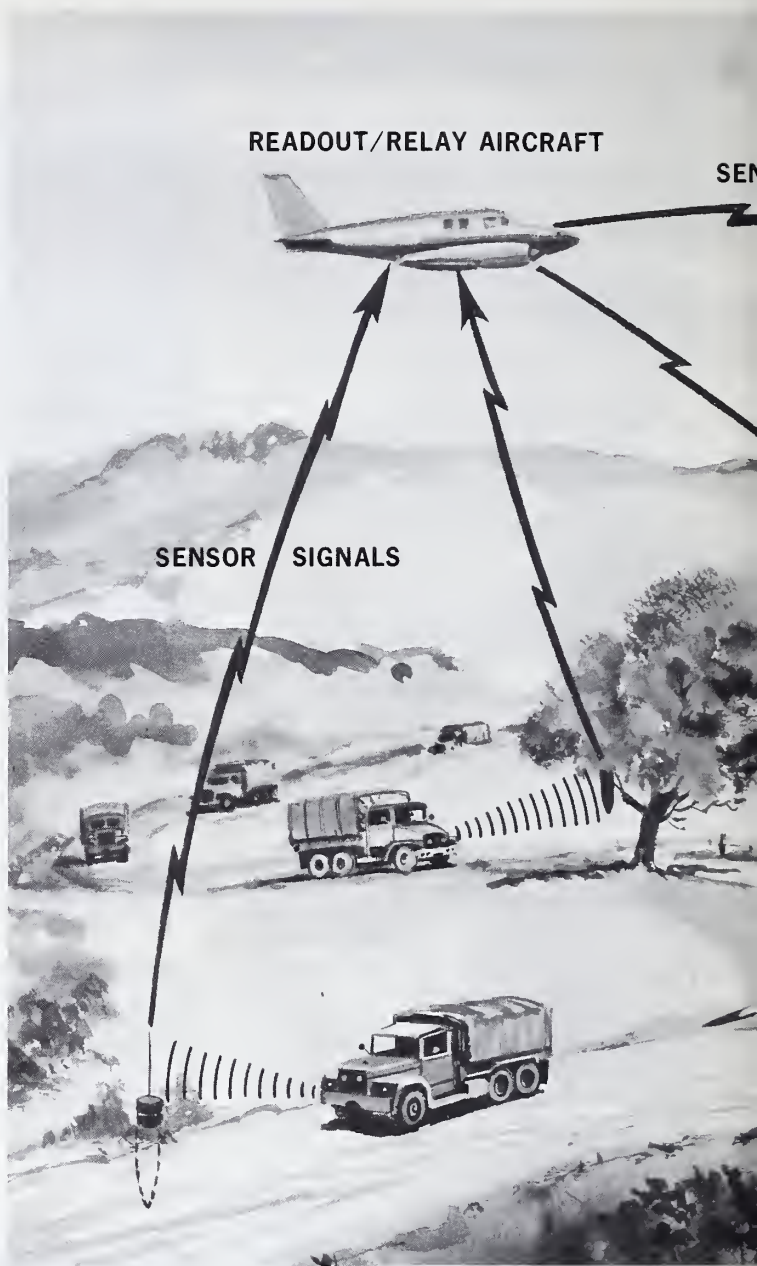
The conventional barrier system was intended to combine sensors to detect enemy intrusions, physical obstacles to impede and canalize enemy movements, and tactical troop units operating from fortified strong point bases to strike at enemy incursions.

Although the conventional barrier system was never fully implemented, by the end of Calendar Year 1967 an over-all Anti-Infiltration System capability for use in Southeast Asia had been developed and deployed.

The success of this initial system was to have a far-reaching impact on operational commanders. The information derived from the use of sensors and related equipment, which was to become more complex and highly sophisticated in a very short time, was found to be invaluable in complementing normal intelligence-gathering systems.

In early 1968, certain air-supported system components were directed to the battle of Khe Sanh. The employment of sensors in the defense of Khe Sanh demonstrated conclusively that improved sensors could be used to great advantage in support of ground combat operations.

In April of that year, the mission of DCPG was expanded to include management responsibility for sensor



Air-Supported System
(Illustration of Basic Concept)

surveillance system components covering a wide range of ground combat tactical applications. These components were to be used in what is referred to as the ground tactical system.

Under this system—known as "Duffel Bag"—DCPG began to provide unattended ground sensors to all U.S. ground forces in Vietnam, rather than confining the devices to their original anti-infiltration role.

The unique mission of DCPG, coupled with extremely compressed time frames to attain objectives, resulted in an unusual management approach. LTG Alfred D. Starbird, DCPG's first director, reported directly to the Secretary of Defense.

DCPG dealt directly with the Joint Chiefs of Staff (JCS), Military Departments and their subordinate organizations, and theater commanders—the users of the DCPG systems.

DCPG tasked the Military Departments to accom-



The ground tactical application depicted above consists of sensors in the ground and in trees sending signals to a read-out relay aircraft as well as to fixed readout installations, followed by air strikes against the enemy. Another theoretical tactical application is depicted on the back cover.

plish actions and was able to use the highest industrial priority in expediting development and procurement of sensor devices.

The Phase I family of sensors sent to Southeast Asia featured air- and hand-placed types. They sensed intrusions by enemy vehicles and personnel either seismically, acoustically or magnetically.

The success of these original sensors in Vietnam generated requirements for sizable quantities of various types. The current Phase III family of sensors, for example, permits the accommodation, on a virtually noninterference basis within the same frequency band, of up to 20 times the number of sensors compared with Phase I items.

Besides reacting to quantitative theater requirements, in consonance with its mission functions, DCPG continually acted on its own initiative to develop, test and field new surveillance devices with improved capabilities.

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ties. This effort, as well as theater operational employment results, has led to the exploration of the use of sensor systems at all levels of warfare.

Because of its ground combat role, the Army had a continuing interest in sensors and their use in Vietnam where ground cover conditions complicated detection of the enemy. Under the DCPG program, a number of sensors were developed in Army laboratories, principally those at HQ Electronics Command (ECOM), Fort Monmouth, N.J., and the Mobility Equipment Research and Development Center (MERDC), Fort Belvoir, Va.

Throughout their use in Vietnam, the sensor surveillance systems were given credit for helping to save the lives of many servicemen, and for substantially reducing the number of U.S. casualties.

Sensors can assist in saving lives by:

- Preempting enemy attacks on U.S. fire bases.
- Locating the enemy with sufficient accuracy to permit effective engagement by artillery and air instead of ground troops.
- Preventing enemy disruption of U.S. lines of communications through costly laying of protective mine fields.
- Tracking enemy movement into the so-called rocket belts around major cities and installations. (In addition, they can be used to improve the security around U.S. installations.)

The success achieved within the framework of DCPG-supported sensor surveillance systems resulted, in December 1970, in an expansion of DCPG mission functions. DCPG's expanded role encompassed a wide range of new projects designed to enhance sensor system capabilities.

Concurrently, in April 1971, the DCPG was redesignated as the Defense Special Project Group (DSPG) to reflect more accurately the scope of its revised responsibilities.

Presently directed by MG John R. Deane Jr., U.S. Army, DSPG now coordinates all sensor-related programs of the Military Departments for the Office of the Secretary of Defense, in addition to its original sensor surveillance system development responsibilities.

This has enabled the Department of Defense to help prevent unnecessary duplication of effort, ensure inter-Service compatibility of equipment, and identify areas requiring additional efforts involving sensor developments.

Additionally, the scope of the organization's activities since April includes direction of a physical security development program, and an investigation into the use of sensor systems for worldwide application.

In the meantime, designated operational systems related to the sensor development program for Southeast Asia have been transferred to the Army, Navy and Air Force.

Despite its new role and proven effectiveness in getting the job done, the DSPG faces dissolution as of June 30, 1972, due to fund reductions being earmarked by Congress. The thinking is that the agency has completed its mission and that the individual services can build on a solid foundation in meeting their respective sensor system requirements. The Advanced Research Projects Agency (ARPA), Office of the Director of Defense Research and Engineering, also is expected to share in future systems development.

Approximately 200 DSPG military and civilian staff members take satisfaction in pointing to a record of substantial achievement—attesting that their efforts over the years have contributed immeasurably to the saving of many American lives in Vietnam, and the probable future saving of lives in other theaters of operations.

WSMR Holds Atmospheric Modification Theme Review

State-of-the-art progress reports on seven U.S. Army projects directed toward acquiring basic knowledge that eventually might contribute toward developing techniques for modifying the atmosphere were given recently.

The first U.S. Army Military Theme Review ever held on Atmospheric Modification was held Nov. 30–Dec. 1 at the Atmospheric Sciences Laboratory, White Sands (N. Mex.) Missile Range. The ASL is one of the Army's primary laboratories concerned with research to advance weather modification.

Reports covered research conducted since the Military Theme on Atmospheric Modification was initiated in the 1970 Army R&D program.

Military themes are defined as "critical Army problems in applied research or exploratory development where progress has been inhibited by a lack of understanding of fundamentals, or a scarcity of basic data, coupled with suggested areas for basic research de-

signed to provide the data and knowledge required for resolving the problem."

Sponsored by the Army Research Office-Durham (ARO-D), N.C., the Military Theme Program and review meetings are designed to encourage communications between Army scientists and principal investigators supported through ARO-D basic research grants and contracts.

Atmospheric modification is listed among more than 50 military themes where problem areas require basic research contributions primarily in mathematics or the physical, engineering and environmental sciences.

The Army has a vital interest in the extent to which certain neutral and electrical atmospheric properties and processes can be modified as related to military requirements.

Modification of the neutral atmosphere requires an improved knowledge of its properties and the dynamic processes resulting in the formation, growth, and dissipation of

clouds, particularly warm clouds, snow and haze. Specific areas of interest include:

- Mechanism of droplet formation from condensation nuclei and growth of cloud droplets and ice particles, including hail.
- Development of models that predict formation of clouds and precipitation.
- Modification of electrical properties of the atmosphere and climate.

Ongoing projects in atmospheric modification reviewed at the WSMR meeting and the principal investigators involved are:

"Condensation Nuclei and Aerosol Populations Related to Fog Formation," F. L. Ludwig and Elmer Robinson, Stanford Research Institute; "Surface Effects on Cumulus Scale Convection," Dr. R. S. Greenfield, The Center for the Environment and Man, Inc.; and "The Electrical Effects of Lightning on Thundercloud Precipitation Development," Dr. Bernard Vonnegut and C. T. Phelps, State University of New York; "An Experimental Study of the Freezing of Drops in Free Fall," Dr. Thomas E. Hoffer, University of Nevada; and

"A Study of the Terminal Velocity, Breakup and Shape of Low Surface Tension Water Drops," Robert T. Ryan, Arthur D. Little, Inc.; "Ultra-high Resolution Radar Probing of Fine-Scale Atmospheric Structures," Dr. David Atlas, the University of Chicago; "The Role of Electrical Forces in the Development and Dissipation of Clouds and Fogs," Dr. John Latham, the University of Manchester.

TACOM Develops EPA-Certified Low-Emission Engine

The first and only engine meeting tough federal standards for low-emission pollution levels has been developed under direction of the U.S. Army Tank Automotive Command (TACOM), Warren, Mich.

Certified recently by the Environmental Protection Agency (EPA), the 4-cylinder, 72-horsepower Army engine shows signs of passing all tests required to meet the government's exacting 1967 standards.

William Ruckelshaus, EPA administrator, announced the successful test results. Disclosure came one day after President Nixon, speaking in Detroit, said an announcement about a low-pollution engine was imminent.

Referred to by TACOM as the "hybrid combustion" or "stratified charge" engine, the power plant used in the test basically is an existing jeep engine modified for the Army by the Ford Motor Co.

Wayne Anderson, director of the TACOM Propulsion Systems Laboratory, explained: "We refer to it as a stratified charge engine simply because the fuel is burned at the location where it has the best mixture of air and fuel to give us the most efficient combustion cut down on a number of pollutants."

Unlike the conventional spark ignition engine with a carburetor delivering the air-fuel mixture to the cylinders, the hybrid design features fuel injectors at each cylinder delivering precisely the amount of fuel needed to operate the engine at any given horsepower requirement. This results in lower exhaust emissions at low and intermediate engine loads.

Russell E. Train, chairman of the Council on Environmental Quality, Executive Office of the President, in a letter to MG J. E. Pieklik, TACOM commander, said:

"We have been carefully following the development of your hybrid combustion (stratified charge) engines and are extremely pleased with your progress to date in demonstrating that the emission standards prescribed by the Clean Air Amendments of 1970 can eventually be met."

The Ford engine is one of two currently being tested by TACOM engineers. The other, developed by Texaco Inc. under TACOM's

direction, works on a somewhat similar principle. Texaco delivered two more of its military prototypes in November.

(For details of engine operation, see "TACOM Develops Hybrid Engine for Low Pollution, Fuel Economy," *Army R&D Newsmagazine*, March 1971.)

Project Engineer Illuminates Searchlight Power Claim

In a letter to the editor, James A. Bailey throws "additional light" on an article published on page 27 of the July-August *Army R&D Newsmagazine*.

The article pertains to development of a high-intensity pyrotechnic searchlight at the Feltman Research Laboratory, Picatinny Arsenal, Dover, N.J.

As project engineer for the standard Army Xenon searchlight AN/TVS-3, he disputes Picatinny's claim that the 2 to 6 million candlepower output of its new pyrotechnic searchlight surpasses that of the standard Army Xenon searchlights.

Bailey states that the AN/TVS-3 searchlight, operating at 20 kilowatts, yields one billion candlepower. The AN/GSS-14, 2.2 kilo-

watts, jeep-mounted light, operating from the vehicle electrical system, has an output of more than 100 million candlepower.

"These items," he adds, "are the responsibility of the U.S. Army Electronics Command (ECOM). A new smaller version operating at one kilowatt is currently in limited production. Yielding more than 75 million candlepower, it has been developed by the Night Vision Laboratories of ECOM located at the U.S. Army Mobility Equipment R&D Center, Fort Belvoir, Va.

"Both the 2.2-kw and 1-kw searchlights have been mounted on wheeled and tracked vehicles, aircraft, river patrol boats and observation towers. All Army Xenon searchlights have all-weather operational capabilities."



AN/TVS-3 Searchlight



AN/GSS-14 jeep-mounted light

NASA Slates Mars Soft Landing System Tests at White Sands Missile Range

Three tests in preparation for the United States' first unmanned landing on Mars are scheduled during the summer of 1972 at White Sands (N. Mex.) Missile Range.

As conceived by the National Aeronautics and Space Administration, the flight plan calls for two unmanned "Viking" spacecraft to cover some 460 million miles from earth to make a soft landing on Mars in 1976.

Tests of the Mars landing system at WSMR are in preparation for two Viking launches from Cape Kennedy within a 30-day span in mid-1975.

After a journey of between 300 and 400 days, the first Mars orbiter/lander is scheduled to arrive at its destination sometime between July and October 1976. It will send back data before the second Viking arrives.

The project is described as the most ambitious U.S. unmanned space effort, involving the most complex set of remote experiments over the longest distance ever attempted.

The decelerator system, designed to slow the descent of the Viking lander into the Martian atmosphere, will undergo tests at

White Sands under the over-all management of NASA Langley Research Center in Virginia. The NASA White Sands Test Facility is the project sponsor.

A gigantic balloon capable of holding 34 million cubic feet of gas will be launched by the Air Force Cambridge Research Laboratory to test the Viking decelerator system. Released with 2,800-pound load from Roswell, N. Mex., the balloon will float over the Missile Range, reaching an altitude of 130,000 feet. At that height the test package will be released from the balloon and spin-rocket motors will ignite, boosting the payload to 150,000 feet.

At 150,000 feet, the main parachute will deploy and the decelerator system and aeroshell will separate. The altitude at this point is expected to simulate conditions on Mars.

The test load for the WSMR flights will include a beacon-tracking device to insure immediate recovery of the payload, cameras, temperature and pressure sensors, accelerometers, magnetometers and other vital instruments.

The main objective of the White Sands tests will be to verify the capability of the decelerator system to deploy at a specific mach number and dynamic pressure, and to slow and stabilize the Viking lander.

White Sands Missile Range will provide position data from its radar system, event data from the Optics Branch, and telemetry and recovery services for the tests.

The Viking lander will be equipped to send back photographs of Mars, assay its thin atmosphere, and stretch out a long arm to gather soil samples and analyze them for possible life forms.

The primary mission on Mars will be to search for living organisms, using an integrated instrument capable of yielding data on such characteristics as growth and metabolism. Other objectives include:

- Perform soil and atmospheric chemistry investigations with a molecular analysis instrument.
- Use a camera system to determine the visual characteristics of landing sites and environs.
- Determine seismic activity on Mars.
- Determine the daily and seasonal meteorological parameters on Mars, including temperature, barometric pressure, humidity, and wind direction and speed.
- Determine physical and magnetic properties of the surface.

Project scientists point out that the Viking Project, the United States' most ambitious unmanned space effort, will perform the most complex set of remote experiments over the longest distance ever attempted—460 million miles.

A round trip radio message from Earth to Mars will consume 40 minutes, compared to three seconds for a round trip message to the Moon.

The two spacecraft, laden with scientific equipment, are designed to yield facts that will likely replace century-old theories and "educated guesses."

Fort Huachuca Builds Remote Control Sensor Test Site

Remotely controlled sensor systems will be tested on a new site, approximately one mile by two miles in size, being developed for the Electronic Proving Ground at Fort Huachuca, Ariz.

When completed, the site will allow testing of air-dropped sensors which imbed in the ground and function automatically on impact. Movement of troops and vehicles produces vibrations in the ground which are detected by the sensors.

In developing the new site, an extensive seismic analysis is being made to measure the patterns of vibration produced in the ground from various sources. A complete soil environmental analysis, also being carried out, will determine how different soil compositions on the range transmit vibrations.

The various analyses are being made by representatives of the Army Corps of Engineers Waterways Experiment Station in Vicksburg, Miss.

The Engineers are using three types of tests for their seismic analysis. The first is the drop-hammer test. A 10-inch steel plate, imbedded in the ground, is struck with a heavy steel hammer.

Sensors, in this case geophones, placed at specific distances around the plate record the vibrations in the ground from the impact. The test is repeated at an assortment of locations on the range.

In the second test, a man of average weight walks down a path. Sensors, placed perpendicular to his path at small intervals, record the intensity of vibrations at each point.

The third test is similar to the second, but vehicles are used. A jeep and an armored personnel carrier are tested over both cross-country and graded-road conditions. Sensors are placed at 50-meter intervals out to 1,000 meters.

a known vibration, man or vehicle, should appear on a sensor in a given area.

Another phase of the test will involve five air-drop sites in the test area. Each is selected for its environmental characteristics. One is hardpan, another rocky, and another sand. The purpose is to determine what percentage of the sensors dropped in different terrains will function.

Preparation of the first phase of mapping was conducted by the Engineers during the rainy season in August. The crew will return in February to run the same tests in the same locations during the desert's dry season. Results will show how the amount of moisture in the soil affects transmission of vibrations.

MICOM Nuclear Physicist Gains Exchange Grant

Dr. Thomas G. Miller, an Army Missile Command physicist renowned for his work in nuclear physics, has won a 6-month research travel grant to study at the University of Hamburg in Germany, starting in January.

The award was granted through the Commission for Educational Exchange under an agreement between the Federal Republic of Germany and the United States. The senior research grant program promotes scholarly work and increases mutual understanding between the two countries through the exchange of students, teachers, lecturers and research scholars.

Dr. Miller, who was selected from approximately 100 applicants and is the only federal employee chosen for the Fulbright-Hays Award this year in the scientific and engineering fields, said his research "is planned to promote a better understanding of nuclear forces and to explore peaceful uses of atomic energy."

Employed at Redstone Arsenal since 1958, Dr. Miller is group leader of the Radiation Physics Branch of the Missile Command's Directorate for Research, Development, Engineering and Missile Systems Laboratory.



Dr. Thomas G. Miller

Author of numerous technical papers and published reports, he has conducted extensive studies in nuclear physics at Redstone utilizing a neutron polarimeter. The University of Hamburg has designed a polarimeter which duplicates his Redstone equipment.

Graduated from Berry College in Rome, Ga., with a BS degree in physics, he earned his master's at Emory University in Atlanta and received a PhD from North Carolina State in 1962, using for his thesis work done in Army laboratories. Later, he completed a year of post doctoral work at the Oak Ridge National Laboratory.

Tank-Automotive Command Selects Felder, Banks for Director Assignments

COL Louis F. Felder, formerly Deputy Director of Developments, Office of the Chief of Research and Development, HQ DA, is the new head of the RD&E Directorate, U.S. Army Tank-Automotive Command, Warren, Mich.

TACOM also announced the selection of Dr. William F. Banks as deputy director. He was vice president of Aerojet Nuclear Systems Co., Sacramento, Calif., until he accepted the key position with TACOM.

Holding a BS degree from the University of Maryland and an MBA from George Washington University, COL Felder has been on active duty since 1942. His second of three OCRD assignments was as executive for International Programs in 1964, the first being in 1958.

His military service includes assignments in the Philippines during World War II and in Vietnam where he served two tours. He was assistant deputy chief of the Army section, Military Assistance Advisory Group in Saigon and later commanded the 21st Division Combat Assistance Team. On the second tour of duty, COL Felder also served as senior U.S. adviser to the Republic of Vietnam's 21st Division. He commanded the 8th Special Forces



COL Louis F. Felder

Group (Airborne) in the Panama Canal Zone during 1967-69.

A graduate of the Armed Forces Staff College and the Industrial College of the Armed Forces, COL Felder has been awarded the Legion of Merit with two Oak Leaf Clusters,



Dr. William F. Banks

Bronze Star, Air Medal with 11 clusters, and the Army Commendation Medal.

Dr. Banks earned a BS from Texas A&M College, ranking first in a class of more than 600. He has an MS degree in mechanical engineering from the University of California at Los Angeles (UCLA), another MS in electrical engineering from George Washington University, and a PhD in engineering systems theory from UCLA.

His professional experience spans 25 years, including positions with Space Technical Laboratories, Redondo Beach, Calif., and the Atomic Energy Division of Allis Chalmers Manufacturing Co.

Dr. Banks has published a number of papers in the fields of nuclear power conversion systems development, and holds patents in these areas. He is a registered electrical engineer in California and a registered mechanical engineer in Maryland.

He is an associate fellow of the American Institute of Aeronautics and Astronautics and a senior member of the American Institute of Electrical and Electronic Engineers. Among other professional affiliations, he is a member of the American Nuclear Society, American Society of Professional Engineers, British Institution of Nuclear Engineers, and the British Nuclear Energy Society.

Levin Heads Natick Labs As WAC Becomes Deputy

Command of the U.S. Army Natick (Mass.) Laboratories changed recently as COL William B. Levin succeeded BG Dean Van Lydegraf as commanding general and COL Maxene B. Michl became the first woman installed as deputy CO at the major R&D complex.

COL Levin has served since August 1969 as deputy to BG Van Lydegraf, whose reassignment as deputy chief of staff, Logistics, U.S. Army, Pacific, will become effective in January (definite date unannounced at press time). Lydegraf has been approved for promotion to 2-star rank.

A native of Oregon, COL Levin has a BS degree in chemical engineering from Oregon State University and a master's in food technology from Massachusetts Institute of Technology (MIT).

During an earlier tour of duty with NLABS he served as chief, Technical Plans Office. He

also has served as military coordinator of the Department of Defense Food Program administered by the laboratories, assistant professor of military science at MIT, deputy chief of the U.S. Army Research and Development Group (Europe), and director of food, HQ 1st Logistical Command, Vietnam.

COL Michl has served since September 1970 as military coordinator of the Department of Defense Food Program, following a tour of duty as head of the U.S. Army Women's Army Corps (WAC) Center and commandant of the WAC school at Fort McClellan, Ala.

Her career has included assignments as plans and policy officer, Office of the Director, WAC; secretary of the General Staff, HQ Area Command, Saigon; chief, Plans and Programs Division, Organization Directorate, HQ Combat Developments Command, Fort Belvoir, Va.; and WAC staff adviser, HQ Fourth U.S. Army, Fort Sam Houston, Tex.

COL Michl has a bachelor's degree from the University of Maryland.



COL William B. Levin



COL Maxene B. Michl

Aberdeen Proving Ground Marks 55 Years of Continuing Growth

Aberdeen (Md.) Proving Ground, known as the "home" of Army ordnance development, research and testing, entered its 55th year of operation Dec. 14.

A Presidential Proclamation established the APG as a permanent post in 1917, three months before the United States entered World War I. It developed as and has remained one of the world's foremost military testing installations of ammunition, guns and mobile equipment.

The population of the installation is fairly constant, including approximately 9,000 civilian employees and 7,000 military personnel. The annual payroll of more than \$166 million has a prime impact on the economy of the area. Army procurement in the area is an additional factor of considerable economic consequence.

The July 1971 merger of Edgewood Arsenal with the APG has given the APG commander, COL Warren D. Hodges, responsibility for serving 21 tenant organizations dispersed throughout a land and water area embracing more than 82,000 acres.

The late BG C. L'H. Ruggles, the first commanding officer, was a colonel when the first APG test shot was fired at 2 p.m. Jan. 2, 1918.

Aberdeen's Highest S&E Award Goes to Dr. Frasier

The Kent Award for 1971 was presented recently to Dr. John T. Frasier, acting chief of the Terminal Ballistics Laboratory, Ballistics Research Laboratory (BRL) of the U.S. Army Aberdeen (Md.) R&D Center.

Presented as Aberdeen's highest award to an employee for professional achievement in scientific or engineering fields, the award honors Dr. Robert H. Kent. Known until his death in 1961 as one of the nation's leading ballistics experts, he served as assistant technical director of the Army Ordnance Ballistic Research Laboratories until he retired in 1956.

BRL Director Dr. Robert J. Eichelberger presented the award to Dr. Frasier for scientific research that led to significant advances in stabilization of liquid-filled projectiles; for demonstrating exceptional foresight in planning a comprehensive program for materials research; and for his outstanding contributions in the field of solid mechanics.

Dr. Frasier joined the BRL staff in 1962 as a research physicist in mechanics with the Exterior Ballistics Laboratory. In 1968, he was assigned as assistant to the director until promoted to acting chief of the Solid Mechanics Branch, Terminal Ballistics Laboratory in 1969. He later headed the branch until appointed to his present position in July 1971.

Dr. Frasier has been responsible for experimental and theoretical investigations of the response of materials to dynamic loading, and the propagation of stress-waves in solids resulting from explosive loading, impact, and the deposition of high-energy radiation on or into target material.

HumRRO Releases Tech Reports From ROTOR Project Results

HumRRO (Human Resources Research Organization) has released the second in a series of reports relating to the design of rotary-wing training devices.

"Analysis of Visual Discriminations in Helicopter Control" Technical Report 71-13 contributes to the overall objectives of HumRRO Work Unit ROTOR (Design of Rotary Wing Training Devices).

These include analysis of helicopter control activities to determine basic pilot behaviors, and to relate them to task difficulty, trainer characteristics, cost, and transfer of training.

Technical Report 71-13 is available to military and civilian agencies working for improved helicopter pilot training and encompasses two phases of research—response characteristics of the helicopter as it reacts to control inputs and external disturbances; and cue structure of the helicopter pilot's visual environment.

Since the analysis might be of interest to both psychologists and engineers, certain sections of the report have been developed in greater detail than might be necessary for either profession. This was done with the idea that the visual analysis may effectively communicate to a range of disciplines.

The study was sponsored by the Office of the Chief of Research and Development, HQ DA, and copies of the report may be obtained from: HumRRO, 300 North Washington St., Alexandria, Va. 22314.

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He is credited with correlating information from the basic and applied program to provide inputs relating the dynamic loading of solids to target penetration mechanics, and the responsive effects of materials to high-level radiation.

Currently, Dr. Frasier is responsible for research directed to establishing a scientific basis for evaluating and improving terminal effects of conventional and special weapons and for devising methods to protect targets.

Investigations include theoretical and experimental studies of detonation fragmentation, penetration, and air-blast phenomena; the interactions between explosives and solids; and the response of materials to damage mechanisms.

Dr. Frasier also acts as a consultant to Army Materiel Command and Department of Defense agencies on material response to dynamic loading, the dynamics of liquid-filled shells and solid mechanics in general.



KENT AWARD WINNER Dr. John T. Frasier shares proud moment with daughters Charolette, 6, Susan, 8, and wife Eleanore, following presentation ceremony at the U.S. Aberdeen R&D Center. Portrait in background is that of the late Dr. Robert H. Kent, early BRL director.

OCTF Saves APG Collection, Funds New Museum

Distinctively identifying the entrance to a new \$250,000 Army Ordnance Museum at Aberdeen (Md.) Proving Ground, scheduled for dedication in May 1972, will be a famed World War II T-12 bomb, pedestaled on its nose.

Construction of the museum was started recently with ground-breaking ceremonies and is being funded by the Ordnance Center of Technology Foundation, Inc., through subscriptions. The OCTF is a private organization of eminent citizens concerned with retaining the famous ordnance collection at Aberdeen Proving Ground.

The former museum was closed Mar. 3, 1967 to make way for the U.S. Army Test and Evaluation Command headquarters building. Since that time, most of the exhibit items have been in storage. The foundation project came into being after all attempts failed to find a suitable site for the exhibits.

COL George B. Jarrett (USA, Ret.), president of the foundation, said the museum will be donated to the Army for operation by the U.S. Army Ordnance Center and School. It "will make these world-famous exhibits available once again for public viewing and for the furthering of engineering research in weapons, ammunition and equipment."

The collection of military materiel specimens, both American and foreign, now assembled at APG has been described as "the most outstanding in the world"—historically priceless, irreplaceable, and representing more than a century in the development of the American defense potential.

The new Ordnance Museum, which will be augmented by the broad outdoor displays of vehicles and weapons surrounding it, will be a highly specialized institution. It will contain examples of both past and present thinking in the field of ordnance materiel.



FAMED T-12 BOMB, posed uniquely on its nose, marks what will be the entrance to a new Army Ordnance Museum at Aberdeen (Md.) Proving Ground. American and foreign tanks in the background had to be moved from the building's flooded construction site.

Recent OCRD Assignments List 12 Military, 3 Civilian Personnel

Assignments of 12 military officers and three professional civilian employees who have recently reported for duty with the Office of the Chief of Research and Development, Department of the Army, are:

COL William F. Boiler has been assigned as deputy director of the Advanced Ballistic Missile Defense Directorate, Office of the Chief of Research and Development (OCRD), after a tour of duty in Vietnam as senior military adviser, Civil Operations Revolutionary Development Support (CORDS), Military Region I, Military Assistance Command.

COL Boiler attended the U.S. Army War College in 1966-67 and following graduation was assigned as deputy chief, Command Information Division, Office of the Chief of Information, Department of the Army. He was CO of the 10th Artillery Group in Germany (1968-70).

A 1945 graduate of the U.S. Military Academy, he received a master's degree in journalism in 1958 from the University of Florida. In 1956 he graduated from the Army Command and General Staff College. He has been awarded the Legion of Merit (LOM) with two Oak Leaf Clusters (OLC).

COL Walter E. Meinzen, new Deputy Director of Development, OCRD, recently completed a tour of duty with XXIV Corps G-3 and ODCSOPS, U.S. Army Vietnam.

He was chief of the Combat Arms Systems Division, Assistant Chief of Staff for Force Development (ACSFOR) in 1969-70 and in 1967-68 was deputy director of instruction, Fort Benning, Ga. In 1965-66, he was deputy G-4, HQ 1st Field Force Vietnam at Nha Trang and a battalion commander with the 101st Airborne Division in Vietnam, following duty as a test officer on the U.S. Army Infantry Board at Fort Benning.

COL Meinzen received a 1948 BS degree in engineering from the United States Military Academy (USMA) and, in 1963, a master's degree in mechanical engineering from Mississippi State University. In 1969 he earned an MA in business administration at George Washington University.

His military honors include the Silver Star (SS), the Legion of Merit (LM) with Oak Leaf Cluster (OLC), the Bronze Star for Valor (BSV), the Bronze Star (BSM) with OLC, the Air Medal (AM) with "V" device, the Combat Infantryman's Badge (CIB), and the Vietnamese Armed Forces Honor Medal, First Class.

LTC Tommy D. Marlatt is newly assigned to the Advanced Ballistic Missile Defense Agency as chief, Program Management Division, following service as commander of the 4th Battalion, 44th (HERC) Air Defense Artillery in Korea.

During 1967-70, he was an action officer in the Directorate of Plans, Deputy Chief of Staff for Logistics (DCSLOG) and from 1964-66 was assistant G-4, 32d Air Defense Command in Germany. He served as documentation coordination officer for Nike Zeus at HQ Army Air Defense Command.

LTC Marlatt has attended Army Command and General Staff College. He has a bachelor's degree in general education from the University of Omaha (1964) and an MS degree from the University of Southern Cali-

fornia (1966).

He has received the LM, BSM, the Meritorious Service Medal (MSM) with OLC and the Army Commendation Medal (ARCOM) with OLC.

LTC George Ragovis, newly assigned as a staff officer in the Management Information Division, R&D Information Systems Office, graduated this year from the University of Rochester with an MS degree in business administration (systems analysis).

During 1967-69, he was a logistics staff officer (ADP), Office of the Deputy Chief of Staff for Logistics, HQ U.S. Army Europe and in 1966-67 was chief, Office of Data and Financial Management (Comptroller) for the Defense Contract Administration Services Region (DCASR), New York. In 1965, he was deputy chief, Office of Data and Financial Management (Comptroller), Cleveland, Ohio.

LTC Ragovis was graduated from Georgia Tech in 1955 with a bachelor of science degree in chemical engineering, and has completed the Army Command and General Staff College course.

A management information specialist and a contracting officer, he has been involved with automatic data processing since 1965. Graduated from the defense procurement course at the Army Logistics Management Center, Fort Lee, Va., he also has completed the Army Comptrollership course at Fort Benjamin Harrison, Ind.

His military honors include the Bronze Star Medal (BSM), Meritorious Service Medal (MSM), and the Joint Services Commendation Medal (JSCM) with OLC.

LTC C. F. Hastings Jr. has been assigned as staff officer with the Fire Support Missiles Branch, Directorate of Missiles and Space, OCRD.

He recently returned from a tour in Vietnam, where he served as executive officer, 23d Infantry (Americal) Division Artillery, and executive officer of the 4th Infantry Division Artillery.

During 1968-70 he commanded the 3d Battalion (Pershing) 84th Artillery, Heilbronn-Neckarsulm, Germany, and in 1967-68 was a student at the Army Command and General Staff College, Fort Leavenworth, Kans.

From 1965 to 1967, he was assistant professor of military science at Knox College, Galesburg, Ill., following duty as commander, 1st Battalion (105 Howitzer), 15th Artillery, 2d Infantry Division in Korea. Prior to this, he was executive officer, 2d Battalion, 15th Artillery with the 2d Infantry Division, also in Korea.

LTC Hastings has attended the Army Command and General Staff College, and holds a BA degree in education from the University of Nebraska at Omaha.

Among his military honors are the LM, Air Medal (AM) (1 through 4), Distinguished Service Medal (DSM), Korean Service Medal (KSM), United Nations Service Medal (UNSM), ARCOM with Oak Leaf Cluster (OLC), BSM, Meritorious Service Medal (MSM), Vietnamese Service Medal (VSM), Vietnamese Gallantry Cross (VNGC) with Palm, and the Vietnamese Commendation Medal (VCM) with "60" device.

LTC Robert A. Bonifacio reported for duty

with the Motivation and Training Laboratory, Manpower Resources Research and Development Center, OCRD. He recently completed a tour as chief, Aviation Plans, HQ U.S. Army Vietnam.

While in Vietnam he also served with the 164th Aviation Group as commander, 307th Combat Aviation Battalion, and was temporary CO and deputy CO, 164th Aviation Group.

Prior to duty in Vietnam, he was chief, Combat Support Aircraft Branch, Air Mobility Division, OCRD.

LTC Bonifacio has attended Army Command and General Staff College (associate course) and holds a 1966 bachelor's degree in general education from the University of Nebraska.

Among his military honors are the LM with OLC, the Distinguished Flying Cross (DFC), BSM, ARCOM, MSM, AM with ten Oak Leaf Clusters, VCG with Bronze Star, VCG with Palm, Korean Unit Citation (KUC), Meritorious Unit Citation, Combat Infantryman's Badge (CIB), Senior Aviator Badge, and Master Parachutist Badge.

MAJ James E. Turner is a new staff officer in the Medical and Biological Sciences Branch, Life Sciences Division, OCRD, and until recently was senior adviser, Sector Management and Direct Support Logistics Center, USMACV, Kien Phong Province, South Vietnam.

During 1969-70 he was a student at Michigan State University following duty (1967-69) with the Department of Doctrine Development, Literature and Plans, Quartermaster School, Fort Lee, Va. In 1966-67 he was S-4 for the 509th Radio Research Group and 8th Radio, Research Field Station in Vietnam, and during 1964-66 was supply officer at Fort Greely, Alaska.

MAJ Turner received a BS degree in dairy technology from the University of Nebraska in 1957, and a master's degree (with honors) in business administration (food marketing) from Michigan State University in 1970.

He has been awarded the BSM and the ARCOM.

MAJ Thomas H. Huber is newly assigned to the Management and Evaluation Division of the OCRD, and recently returned from Vietnam as director of maintenance, HQ 29th General Support Group at Long Binh.

In 1970 he was director of Countermeasure Programs, Mobility Equipment Research and Development Center (MERDC) at Fort Belvoir, Va. From 1968 to 1970 he was at the MERDC as chief of the Engineering Systems Laboratory. He was a student at the Ordnance School, Aberdeen (Md.). Proving Ground (1967-68). In 1966-67 he was assistant G-4, 7th Infantry Division, Korea.

MAJ Huber received a BS degree from the United States Military Academy at West Point (USMA) in 1960, and an MS in engineering science from Purdue University in 1966.

He has received the BSM, MSM, and ARCOM.

MAJ Albert A. Mullin is a staff officer in the Mathematics Branch of the Physical and Engineering Sciences Division of the Office, Chief of Research and Development. He re-

ports from duty as executive officer, Logistics Data Service Center, U.S. Army Vietnam.

MAJ Mullin from 1968 until 1970 was deputy chief of Systems Analysis Office for the U.S. Army Materiel Command Tank-Automotive Command. He was a research associate at the Livermore Research Laboratory in Livermore, Calif., during 1964-66, and a research assistant at the University of Illinois at Urbana from 1957 until 1964.

MAJ Mullin has attended Basic and Advanced Training for Ordnance Officers, and has a bachelor of science degree in electrical engineering which he received from Syracuse University in 1955. In addition, he earned a master of science degree in electrical engineering from MIT in 1957, and a master of science degree in mathematics from the University of Illinois in 1961.

MAJ Mullin is a recipient of the BSM.

CPT Ray A. Gross Jr. is a new staff officer in the Materials Sciences and Technology Branch of the Physical and Engineering Sciences Division, OCRD.

Assistant division chemical officer for the 1st Air Cavalry Division in the Republic of Vietnam during 1970, he also served there as commander of the 184th Chemical Platoon (DS), 1st Air Cavalry and chemical officer, 3d Brigade, 1st Infantry Division.

In 1961 CPT Gross received a BS degree in chemistry from the University of Tulsa, and in 1969 an MS degree in organic chemistry from the University of Oklahoma.

His decorations include the BSM with OLC, AM with two OLC and the ARCOM with three OLC.

Gerald W. Beveridge is a new supervisory technical information specialist in the U.S. Army Research and Development Information Systems Office (ISO). Until recently he was chief of the Technical Information Division at Fort Detrick, Md.

His military schooling includes Officer Candidate School with the Medical Service Corps and Chemical Corps military science courses at Fort McClelland, Ala. While on active duty he was an instructor, Chemical Officer Career Extension Course (1962-64). He served as a test officer during the atomic bomb tests at Bikini Atoll in the Pacific.

Beveridge attended Brooklyn College and the City College of New York, and is a graduate of the Automatic Data Processing and Systems Analysis Course at Fort Benjamin Harrison, Ind.

In 1970 he received a Certificate of Achievement from Fort Detrick, and an Outstanding Performance Award in 1965.

He has collaborated in publications on botulinum toxoids, alum precipitated toxoids and the chemotherapy of viruses.

Wesley H. Ruth was program manager for Applied Data Research, under contract with the U.S. Army R&D Information Systems Office (ARDISO), prior to his present employment as a technical information specialist, Scientific and Technical Information Branch, ARDISO.

During 1964-65, he was a chemistry instructor at Bullis (Md.) Preparatory School, following employment as an information and systems analyst with Itek Corp. (1960-62); and GE Co. (1960).

Ruth served 22 years with the U.S. Navy as an aviator, including 1943-44 duty at Pearl Harbor and as officer-in-charge, Naval Air

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Transport Service, Aircraft Training Unit, Moffett Field, Calif., and 1956-60 duty with the Joint Intelligence Staff in the Pentagon.

Ruth earned a BS degree in chemistry from South Dakota State College in 1936. His military education includes completion of courses at the USN flight and photographic schools at Pensacola, Fla., and the General Line School, Newport, R.I.

Philip A. Farris, a 1946 U.S. Military Academy graduate with a master's degree in journalism from the University of Missouri, has joined the *Army R&D Newsmagazine* staff as an associate editor.

Until Nov. 1 he was editor of the alumni magazine *Assembly*, published at the U.S. Military Academy and was previously a

writer with a national advertising agency.

A speechwriter for former Secretary of the Army Wilber M. Brucker, he won a Freedoms Foundation essay award in 1956, and has had articles published in a number of magazines.

Until 1966 he served 20 years on active Army duty, including duty with the 187th Airborne Regimental Combat Team during the Korean War, command and staff positions with the 138th Anti-Aircraft Artillery Group in Japan, and as a public information officer, HQ Seventh U.S. Army in Germany.

He was assigned to the Information Office, HQ U.S. Army Continental Command before becoming director of advertising and information, U.S. Army Recruiting Command in 1965.

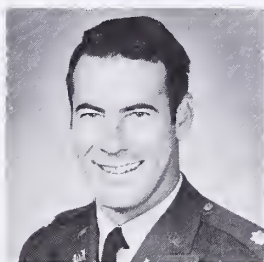
Hudson Named Waterways Experiment Station Deputy

Assignment as deputy director of the U.S. Army Engineer Waterways Experiment Station (WES), Vicksburg, Miss., gives MAJ Ronald E. Hudson responsibility for assistance in administering more than 1,000 WES research studies.

WES conducts research and engineering investigations in hydraulics, soil mechanics, mobility of military vehicles, environmental factors, nuclear and conventional weapons effects, flexible and prefabricated pavement design, and concrete technology.

MAJ Hudson recently completed a tour of duty in Vietnam as CO, 62d Aviation Company and engineer for the USARV aviation officer. During 1967-68, he was operations officer and battalion executive officer of the 299th and 20th Engineer Battalions (Combat) in Vietnam.

Graduated from the U.S. Military Academy (USMA) in 1958, he has master's degrees in civil engineering, and in theoretical and applied mechanics, from the University of Illinois. During a 3-year tour he was an assistant professor in the Department of Mechanics at the USMA. He is a graduate from the Engineer Officer Career Course, the Command and General Staff College, and the Army Aviation School.



MAJ Ronald E. Hudson

MAJ Hudson is a registered professional engineer in Illinois and is a member of the Society of American Military Engineers. His decorations and awards include the Bronze Star Medal with Oak Leaf Cluster (OLC), Air Medal, Army Commendation Medal with two OLC and the "V" device, Purple Heart, Meritorious Unit Commendation, National Defense Service Medal with OLC, the Vietnam Service Medal, and the Republic of Vietnam Campaign Medal.

White Sands Technician Engineers Facelift for VTM System

An innovative engineering technician at White Sands Missile Range, N. Mex., has given a new "face" and configuration to its VTM (versatile tracking mount) optical unit.

Larry Covington, assigned to WSMR's Optical Branch of the Data Collection Division, National Range Operations Directorate, is given credit for much of the VTM's new glamor and self-containment features.

Conversion of the mobile optical system, used for gathering scientific data during missile firings, began with removal of the bed

from the M-55 5-ton truck prime mover. Directly behind the cab, Covington installed a van-shell to house the instrument control panels.

The tracking instrument was mounted on a trailer to be pulled by the truck. Then, the entire assembly—truck, generator, control van and the instrument trailer—was painted a gleaming white.

Before the renovation, the \$7 million VTM systems at White Sands were neither "glamorous" nor self-sustaining.



DRESS-UP M-55 Army truck, complete with power generator, control van and optical trailer, is ready to move at White Sands (N. Mex.) Missile Range for a missile test.

Major Army RDT&E, Procurement Contracts Exceed \$671 Million

Army contracts for research, development, test, evaluation and materiel or services procurement totaled \$671,200,443 from Oct. 1 to Nov. 30. This list includes only contracts exceeding \$1 million.

National Presto Industries is receiving \$117,738,400 for 105mm projectile parts, M-1, covered by three contracts. A. M. General Corp. was awarded \$74,961,822 (two contracts) for 2½-ton and 5-ton trucks.

Chrysler Corp. gained contracts totaling \$47,172,600 for M60A1 tanks, AVLB chassis, M60A2 tank retrofits, M37 trainee retrofits, and M60A2 tank parts.

Four contracts totaling \$42,444,136 with Day and Zimmermann, Inc., are for processing ammunition components. Work will be done at the Lone Star Army Ammunition Plant, Texarkana, Tex., and the Kansas Army Ammunition Plant, Parsons, Kans.

Harvey Aluminum Sales, Inc., will receive \$29,455,772 (three contracts) for operation and maintenance of an ammunition facility at Milan, Tenn. Hughes Aircraft Co., received a first-year increment of \$25,524,000 for procurement of TOW missiles; the total value of the contract will be \$99,622,299.

Three contracts totaling \$21,090,661 with Chamberlain Manufacturing Corp. are for 81mm, 152mm and 175mm projectile parts.

Army FAB Tests Fire Direction Systems at Fort Sill

Two new equipment systems, designed to help the artilleryman determine his location and direction of fire for accurate delivery on targets, have been tested by the U.S. Army Field Artillery Board, Fort Sill, Okla., and results are being evaluated.

Doppler Translocation. This system was tested throughout the Southwest United States in a joint Army-Marine Corps effort, the board announced Nov. 17. COL Harold V. Madden heads its Test Division.

Miniaturized, portable receivers are used to tune in on broadcasts from the Navy's Navigational TRANSIT Satellite as it swings in polar orbit around the earth. Based on the data received, an equally small computer very quickly gives the location of the receiver on the ground, usually within 10 meters.

Results of the tests are not complete but CPT George V. Dell, the board's project

Olin Corp. was granted three contracts totaling \$20,328,391 for .45-caliber ball cartridges, illuminating cartridges and operation of the Indiana Army Ammunition Plant, Charlestown, Ind.

General Motors Corp., will receive \$19,907,520 (four contracts) for a research and development study program, work on the XM803 combat tank, transmission kits for M60 tanks and XTG-411-2A transmissions for M10 and M578 vehicles. Federal Cartridge Corp. was issued an \$18,073,531 contract for operation of an ammunition production facility and support services for various projects.

Under four contracts with Raytheon Co. totaling \$14,501,846, work will be done on the SAM-D missile system, CAMEL radar research and parts for bomb fuzes, M904E3. Hercules, Inc., was issued a \$12,307,599 award for maintenance of the Radford, Va., Army Ammunition Plant. Uniroyal will receive \$11,489,280 for operation and maintenance of the Joliet, Ill., Army Ammunition Plant.

Honeywell, Inc., gained \$11,477,504 (two contracts) for research and development on artillery munitions and on grenade fuzes, M219E1. White Engines Inc., will be paid \$11,403,822 for multifuel engines for 2½-ton trucks and Ingraham Industries was granted \$10,894,769 for M564 and M565 fuzes.

officer, believes the system "should prove especially valuable in remote areas of the world where accurate survey points are scarce or nonexistent."

Azimuth Gyroscope. In tests, this lightweight system produced directional information accurate to hundredths of a degree in as little as 15 minutes.

MSG Alfred T. Anderson, who supervised the tests, commented: "If the lightweight gyro proves itself, it will let us produce reliable, accurate directional information much faster than with normal survey methods and without the logistical problems encountered in hauling the older gyro equipment around."

"The system may free us from dependence on the good weather needed to make astronomical observations; this can be very important when you consider the long rainy season in some parts of the world."

Thiokol Chemical Corp. was issued a \$10,730,920 contract for operation and maintenance of the Long Horn Army Ammunition Plant, Marshall, Tex. An award of \$10,161,510 to Colt's, Inc., is for supply of M16A1 rifles and M16 rifles.

Contracts under \$10 million. Remington Arms Co., \$9,550,409 for operation of a small arms facility and related support activities; Research Analysis Corp., \$8,009,491 for research and scientific studies for improvement of Army Tactical Operations; and

AVCO Corp., \$7,374,183 (three contracts) for turbine nozzles for T53 aircraft engines and radio receivers, R-1444/UR; and

Hamilton Technology, Inc., \$7,190,605 for MT fuzes, M565; Western Electric Co., \$6,885,071 (four contracts) for work on the Safeguard ballistic missile defense system, and for field and laboratory tests and analysis of Bell System equipment for the Safeguard Communication Agency; General Time Corp., \$6,564,787 for MTSQ fuzes; Sanders Associates, \$6,345,773 (two contracts) for engineering services for the Forward Area Alerting Radar (FAAR); and

Gulf and Western Industries, \$6,153,049 (two contracts) for M103 brass cartridge cases and 20mm incendiary projectiles, M56A4; Norris Industries, Inc., \$5,989,301 (three contracts) for maintenance of the 105mm cartridge case production, operation of Riverbank Army Ammunition Plant, 81mm projectile parts and motor tubes for 2.75-inch rockets; and

Centron, \$5,746,916 for 105mm projectile fiber containers, Kennedy Van Saun Corp., \$5,514,271 for 105mm projectile parts, M489; Metal Container Corp., \$5,159,000 for metal ammunition boxes.

Contracts under \$5 million. RCA Corp., \$4,865,281 (two contracts) for R&D on CAMEL radar and engineering services for the Land Combat Support System (LCSS); Wells Marine, Inc., \$4,455,899 for 20mm target practice projectiles, M55A2; McDonnell Douglas Corp., \$3,477,292 (two contracts) for electronics equipment and services and testing of Dragon missile system; and

Northrop Corp., \$3,068,835 for warheads for 2.75-inch rockets; Teledyne, Inc., \$3,018,500 (two contracts) for cylinder assemblies for M48 and M60 tanks and engineer support for multifuel engines; Ravenna Arsenal, Inc., \$2,684,457 (two contracts) for maintenance support services at the Ravenna Army Ammunition Plant; and

Southwest Truck Body Co., Inc., \$2,235,275 (two contracts) for 12-ton stake semitrailers; Rand Corp., \$2,103,825 for research of military science and technology; Marathon Battery Co., \$2,007,848 for dry batteries for AN/PRC-25 radio sets; and

Mohawk Electronics Corp., \$1,861,774 for electric blasting caps; Standard Products Co., \$1,752,319 for track shoe assemblies, T142; Computer Science Corp., \$1,722,508 for programming support; and

Barry L. Miller Engineering, Inc., \$1,696,479 for metallic belt cartridge links; Page Communications Engineers, Inc., \$1,683,748 for engineering and management advice for the Republic of Vietnam Armed Forces Communication Management Agency; and



Azimuth Gyroscope



Doppler Translocation

Kollsman Instrument Corp., \$1,660,560 for electric firing devices for mines, M57; Golden Industries, Inc., \$1,638,204 for 155mm projectiles; The U.S. Small Business Administration, \$1,609,765 for communication equipment; Martin Marietta Corp., \$1,520,330 for engineering services for the Pershing missile system; Mason and Hanger, Silas Mason Co., \$1,488,432 for operation and maintenance of GOCO ammunition facility; MPS Systems Corp., \$1,450,000 for work on 12,000-pound capacity biaxial test machine; and

Associated Springs Corp., \$1,409,800 for 5.56mm cartridge clips; Bendix Corp., \$1,348,322 for industrial engineering services; Engineering Research, Inc., \$1,331,134 for adapter booster bombs; Conover Co., Inc., \$1,312,786 for M148 booster adapters; Chandler Evans, Inc., \$1,282,639 for the overhaul of 589 turbine engine fuel controls for UH-1 aircraft; Tampa Ship Repair and Drydock Co., Inc., \$1,260,989 for the repair of the dredge Langfitt; and

The Brown Engineering Co., Inc., \$1,233,126 for R&D and analysis in support of the Advanced Ballistic Missile Defense Agency; Goodyear Tire and Rubber Co., \$1,213,817 for track shoe assemblies for self-propelled heavy howitzer; Isotopes, Inc., \$1,169,847 for R&D; Kaman Sciences Corp., \$1,121,107 for lethality and vulnerability study requirements for the U.S. Army Safeguard Systems Command; and

Xyzyx/Parsons (a joint venture), \$1,100,956 for development of data for documentation for Safeguard sites; Stanford Research Institute, \$1,098,320 for development of a polar-orbiting wideband satellite experiment; Federal Electric Corp., \$1,063,226 for operation and maintenance of communication sites; Lynx, Inc., \$1,035,468 for M213 hand grenade fuzes.

Young Selected to Direct TECOM Test Operations

Assignment of COL William H. Young as director of test operations, U.S. Army Test and Evaluation Command, Aberdeen Proving Ground, Md., has been announced by HQ TECOM.

Enrolled in the Army Research and Development Officer Program since 1960, he served at HQ DA staff level in the Combat Materiel Division, Office of the Chief of R&D (1959-60) and returned in 1966 for a second tour of duty in the Management Evaluation Division and, concurrently, assistant director, Plans and Programs.

Assigned to the Agency for International Development (AID) in June 1967, he was sent to Vietnam as an AID representative in Civil Operations and Revolutionary Support activities. He served there in 1965-66 with MACV as sector adviser of Kien Phong Province and, later, as MACV member of an interagency study group on roles and missions of all U.S. Government agencies in Vietnam.

In October 1968, he became a staff officer in the Office of the Assistant Director of Defense Research and Engineering (Operational Test and Evaluation). He was assigned to Vietnam in March 1970 as chief, Territorial Forces Division, serving until returned for his TECOM duties.

COL Young graduated from the U.S. Military Academy in 1946 and earned a master's degree in mechanical engineering from the University of Michigan in 1959. During his 1966-67 OCRD tour, he worked toward his doctorate at George Washington University.

He completed the Infantry Officer's Advanced Course, as well as residency courses at the Command and General Staff College, the Army War College, and the Special Warfare School. He also is qualified as a parachutist and gliderman.

His combat record reflects participation in the Republic of Korea summer-fall 1953 campaign and in eight Vietnam campaigns. Among his military honors are the Vietnamese Army Distinguished Service Medal, second class; the Gallantry Cross with Silver Star; and the Honor Medal, first class.



COL William H. Young

Rapmund Assigned as Chief of OCRD Life Sciences

Assignment of COL Garrison Rapmund, MC, as chief, Life Sciences Division, U.S. Army Research Office, Office of the Chief of Research and Development, Department of the Army, became effective Jan. 3.

COL Rapmund's military record reflects, for a 44-year-old officer, an unusually distinguished career. He will succeed COL Donald L. Howie, MC, who has served since 1967 and is taking a new assignment with Walter Reed Army Institute of Research, Washington, D.C.

Among COL Rapmund's impressive qualifications for his new duties are an AB degree from Harvard in 1949, an MD degree from the College of Physicians and Surgeons of Columbia University in 1953, internship at Bellevue Hospital, New York, and pediatric residency at Babies Hospital, New York, where he was chief resident pediatrician in 1956-57.

He entered military service in 1957 and was assigned to the Diagnostic Section, Department of Virus Diseases, Walter Reed Army Institute of Research, Washington, D.C.

His next assignment was the first of two in which he takes special satisfaction—studying virus and rickettsial diseases at the U.S. Army Medical Research Unit (USAMRU), Kuala Lumpur, Malaysia (1958-60). He returned there in 1964 as chief, Department of Rickettsial Diseases, and in 1965 became commanding officer until 1969.

A quotation from a feature article in the May-June 1970, edition of the *Army Research and Development Newsmagazine*, pages 24-28, attests to the role of the USAMRU. Dr. Allan L. Forbes, MD, then chief of the



COL Garrison Rapmund

Scientific Analysis Branch, Life Sciences Division, OCRD, commented in an official trip report:

"... I feel the Unit exemplifies almost to perfection the best possible type and scope of medical research presence the Army should have overseas. . . . The laboratory is small, inexpensive, staffed with outstanding young officers, and very productive.

"Its productivity is relevant equally to U.S. Army interests and to the public health needs of the host nation and its intermediate neighbors. . . . I have never visited an Army laboratory where I thought we were getting more productivity—both tangible and intangible—per dollar expended than from USAMRU. . . ."

Sandwiched between COL Rapmund's USAMRU (Malaysia) assignments was a tour of duty in the Department of Rickettsial Diseases, Walter Reed Army Institute of Research. In 1969 he returned from USAMRU to become chief, Internal Medicine Research Division, Army Medical R&D Command, Washington, D.C.

Later in 1969 he succeeded to the position of director of Medical Research, then in 1970 to chief, Research Planning Office, and in July 1971 deputy commander of the Medical R&D Command.

COL Rapmund's professional affiliations include: Fellow, American Academy of Pediatrics; member, American Society of Tropical Medicine and life member, Malayan Medical Association and past president of the Malaysian Society of Parasitology and Tropical Medicine.

An ex officio member of the National Research Resources Advisory Council, National Institutes of Health (alternate Department of Defense representative), he is currently The Surgeon General's representative on The Army Research Council, which is concerned with formulating long-range plans.

His military honors include the Legion of Merit and the Army Commendation Medal. In May 1969 he received a Certificate of Appreciation from the Prime Minister of Malaysia for aid during racial disturbances.



MERITORIOUS CIVILIAN SERVICE.

LaVerne R. Grosskopf was recently awarded the Army's second highest civilian honorary award, the Meritorious Civilian Service Award (MCSA). He was formerly chief of the Facilities Division, USAMC Installations and Services Agency, Rock Island (Ill.) Arsenal.

COL Norman F. Lewis, commander of the agency, cited Grosskopf for his professionalism and effectiveness in establishing a Construction Surveillance Program which has saved millions of dollars.

Dr. James K. Magor, associate director, Metallurgy and Ceramics Division, U.S. Army Research Office, Durham, N.C., received the MCSA from COL William J. Lynch, ARO-D commander. Magor was cited for his "exhaustive efforts" in improving techniques of practical metallurgy and mechanical engineering; also, for his service as a metallurgical consultant to Picatinny Arsenal in efforts to improve reliability of gun tubes and projectiles.

SILVER STAR AND DFC. The Silver Star and Distinguished Flying Cross were presented recently to *Dr. James Ralph* for heroism in Vietnam during 1963-64 while serving as an Army doctor and flight surgeon with the 145th Aviation Battalion. Dr. Ralph was presented the Silver Star for his evacuation of battlefield casualties under extremely adverse conditions. The Distinguished Flying Cross was awarded for his "professional skill and cool presence of mind" while performing emergency field surgery.

LEGION OF MERIT. COL *Harold T. Heady*, MSC, was awarded the LOM on his recent retirement from active duty. BG Manley G. Morrison, chief, Medical Service Corps, presented the medal.

Formerly chief of the Facilities Branch,

Plans, Supply and Operations Directorate, COL Heady was cited for his development of a systems study for the planning and design of military medical facilities used in 16 Army hospitals in addition to Navy and Air Force facilities. He also assisted in planning a new Walter Reed Hospital, expected to be one of the most sophisticated ever built.

MG *Frank M. Izenour*, CG of the U.S. Test and Evaluation Command until Nov. 30, received the first Oak Leaf Cluster (OLC) to the LOM upon his retirement after 40 years of military service. MG Charles T. Horner Jr., Army Materiel Command chief of staff presented the award.

LTC *Glenn M. Williams* was awarded the first OLC to the LOM for service with the U.S. Army Medical Command in Vietnam from July 1970 to May 1971 as deputy assistant chief of staff for Plans, Intelligence and Operations.

COL *Nelson W. Tobey* was awarded the LOM second OLC in recognition of his leadership and management as director, Army Missile Test and Evaluation Directorate, White Sands (N. Mex.) Missile Range since July 1970. He came to WSMR from the Office of the Chief of Research and Development, Department of the Army, where he was director for Missiles and Space and is retiring with more than 30 years military service.

COL *Roswell G. Daniels* was presented the LOM prior to his retirement for serving "with distinction in positions of great responsibility" during the past five years. During this period, he was chief of Preventive Medicine, U.S. Army Europe, and director of Medical Services and commanding officer, Army Environmental Hygiene Agency. MG Spurgeon Neel, Deputy Surgeon General presented the award.

COL *Edward E. Bennett*, Chief of the Project Manager ARTADS Field Office, Fort Belvoir, Va., was presented the LOM by BG Albert B. Crawford Jr. COL Bennett was cited for distinguished service in the Ryukyu Islands from 1969 to 1971.

SOLDIER'S MEDAL. BG Edward F. Gudgel presented the Soldier's Medal to SP5 *Garry Rock*. Rock, assigned to the Combat

Developments Command at Fort Belvoir, was cited for his heroic efforts in saving a driver from the cab of his overturned and flaming truck on Virginia Interstate 495 south of Washington, D.C.

BRONZE STAR MEDAL. MAJ *Patricia M. Paulis*, chief, Army Medical Service Corps Procurement Branch, was awarded the BSM for meritorious service with the 24th Evacuation Hospital in Vietnam. COL William A. Boyson, MC, director of Personnel and Training, presented the award.

MAJ *Thomas J. Kochaniewicz* and MAJ *Charlie D. Adkins* were awarded the BSM at Fort Belvoir where they are attached to the U.S. Army Computer Systems Command in the Office of the Deputy of Management Systems. For Kochaniewicz, the award carried the first OLC.

MERITORIOUS SERVICE MEDAL. LTC *Boyd E. Cooksley* recently received the first OLC to the Meritorious Service Medal for service as chief of the Individual Patient Data Systems Project Team. He is presently chief, Patient Administration and Biostatistics Branch, Operations Division, Plans, Supply and Operations Directorate, Office of the Surgeon General. LTC *Max E. Holt*, assigned to the same branch as chief of Systems Management, was awarded the MSM for service as principal staff officer of the team.

LTC *Marion P. Johnson* received the MSM for outstanding service as executive officer, Dunham Army Hospital and also Medical Department activities at Carlisle Barracks, Pa., from October 1967 to June 1971.

LTC *Katherine F. Galloway*, Army Nurse Corps, was awarded the MSM for management of the nursing service and contributions to production of medical films and manuscripts regarding care of burn patients while serving (1968-71) as chief nurse, U.S. Army Institute of Surgical Research at Brooke Army Medical Center, Fort Sam Houston, Tex.

ARMY COMMENDATION MEDAL. LTC *Frank Axtens* received the ARCOM with OLC for outstanding service as chief, Supply and Services Division, Womack Army Hospital, Fort Bragg, N.C. His present assignment is in the Logistics Division, Plans, Programs and Systems Branch.

LTC *Lyndoll Wells*, a nursing consultant in the Facilities Branch of the Directorate of Plans, Supply and Operations, Office of the Surgeon General, received the ARCOM for work as an instructor for the Clinical Specialist Course at Fort Gordon, Ga.

LTC *Eugene C. Richey* was awarded the second OLC to the ARCOM. He is assigned to the Army Computer Systems Command at Fort Belvoir as project officer for the Air Defense Command and Control Office.

MAJ *Donald Omori*, Input/Output Control Division Officer, ACSC, was presented the ARCOM for outstanding performance of duty while serving in the Technical Facilities Directorate (1969-71).

MASTER ARMY AVIATOR'S BADGE. LTC *Blair E. Smith*, was honored with the MAAB, Army aviation's highest award, by achieving over 4,600 hours of flight time, earning a special instrument qualification and serving 19 years as a rated aviator. COL John R. Adie, head of the Eustis Directorate, Army Air Mobility R&D Laboratory, Fort Eustis, Va., made the presentation.



BRIDGE DESIGN WINNERS. Philip J. Haselbauer, Edward B. Swanson, Irving B. Figge Sr. and MAJ Flayll A. Fry were among recent winners of a contest for design of military bridges sponsored jointly by the Society of American Military Engineers (SAME) and the U.S. Army Materiel Command. Cash prizes up to \$5,000 were awarded and they received \$750 for a "Tetra Core" concept developed by the Structures Division, Eustis Directorate, U.S. Army Air Mobility Research and Development Laboratory.

MISCELLANEOUS AWARDS. U.S. Army Mobility Equipment R&D Center awards presented recently included: Jimmie R. Lee, \$450 for 1970-71 civilian service in Vietnam as the center's representative under the Vietnam Laboratory Assistance Program; Richard P. Schmitt, \$100 for authoring an article, "Reverse Osmosis Offers Potential Solution to Water Purification," published in the *Army Research and Development Newsmagazine*; and

Adolph H. Humphreys, initial award of \$50 for design and fabrication of the annual "Gelini Medal," honoring the center's late commanding officer, COL Walter C. Gelini; Frederick A. Post, \$50 for his suggestions concerning oil-pressure switches and emergency shutdown circuits; Richard H. Davis, \$50 for disclosure of his invention of a "color data acquisition camera."

U.S. Army Engineer Topographic Laboratories deputy CO LTC George N. Simcox recently presented John W. Eastes, Edward C. Brown and Abraham Anson with Special Act or Service Awards.

COL Bennett L. Lewis, CO of the U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va., honored 30 employees at a recent awards ceremony. Franklyn P. Good was cited for his work in development of environmental control equipment; Guy F. Origlio, for his work in development of sensors and detectors; and Benjamin L. Spangler for his contribution in the development of bridge equipment.

Mrs. Barbara J. Schulz received recognition as supervisor in the Fiscal Division; Mrs. Inge Freeze as an accounting technician; Mark H. Henderson as chief of the Mechanical Technology Department; Lemuel Osteen as chief, Mobile Assault Bridge Branch; and Francis

MORS Hears Cohen Discuss ABMDA Methodology

B. Paca as acting chief of the Countermine/Counter Intrusion Department.

In a presentation to the 28th meeting of the Military Operations Research Society (MORS), Nov. 17 at Fort Lee, Va., Herbert

N. Cohen discussed one of the systems of models and analyses developed by the U.S. Army Ballistic Missile Defense Agency (ABMDA).

Cohen, a physical scientist/systems analyst at the Arlington, Va., installation, coauthored "Methodology for Minimizing the Deployment Cost of Hardsite Ballistic Missile Defense Systems" with Dr. Stanley S. Dick and Willard W. Perry of Keystone Computer Associates, Inc., Falls Church, Va.

An abstract of the paper follows:

A key problem faced by the advanced weapon system planner is that of determining how improvements in weapon system technology and performance affect over-all weapon system cost-effectiveness. To select a technology for further development, it is not enough to show that development of the technology will significantly improve the performance of a weapon system element.

Rather, the value of the technology under consideration must be shown in the true system context, i.e., it must be shown that incorporation of the technology will significantly improve the over-all cost-effectiveness of the weapon system.

In its role as advanced hardsite defense planner, ABMDA must find a total system cost-effectiveness justification for any decision to proceed with the design of an advanced hardsite defense component. To assist in this process, ABMDA has been developing an analytical system of models and techniques which relate hardsite defense element characteristics and performances to over-all system cost-effectiveness.

The analytical system consists of several separate but compatible computer models and simulations, each of which models one particular portion of the total defense system. For any given problem, the models are linked together in a manner which suits the particular problem requirements and provides results that clearly show the effects desired.

The problem of relating defense element characteristics to total system cost-effectiveness is a particularly complex and difficult one. This is due to the great number of parameters which influence the result, and the fact that when any one defense component is altered it affects the deployment and utilization of all other defense components. The complexity of this problem was the principal reason for developing several small but compatible models rather than one large evaluation model.

ARPA Slates Holography Meet

The Advanced Research Projects Agency (ARPA), Department of Defense, is sponsoring an unclassified symposium, "Engineering Applications of Holography," Feb. 16 and 17 at Los Angeles, Calif.

Emphasis will be on practical engineering applications for the development of new weapon systems. General program chairmen are Dr. S. Ruby of ARPA and Dr. P. G. Bhuta of TRW Systems group. Further information may be obtained from Richard May, TRW Systems group, One Space Park, Redondo Beach, Calif. 90278.

\$14 Million Hospital Honors Achievements

Dedication of a \$14 million Army hospital Dec. 10 at Fort Ord, Calif., featured an address by Army Surgeon General LTG Hal B. Jennings Jr. in tribute to MG Silas B. Hays, whose name it memorializes.

GEN Jennings cited GEN Hays, Deputy SG and later Surgeon General (1951-59) as an administrator and researcher who helped to revolutionize Army medicine during his tenure.

Scheduled for occupancy early in 1972, the 440-bed hospital will provide the most modern medical facilities, and will use the latest computerized and data processing techniques in administration and patient care. All outpatients will be treated in ground-floor clinics.

Laboratory tests will use automatic analyzers, and a modern radiology department will employ closed-circuit television for X-ray studies. A golden griffin emblem, the hospital's crest symbolizing aid and assistance, will be worn by all hospital personnel.

An older cantonment-type hospital was opened at Fort Ord in March 1941, and by 1950 supported the largest training center on the west coast. Plans for the new structure received Congressional approval in the mid-1960s.

Gorgas Medal Goes to Dr. Artenstein of WRAIR

Dr. Malcolm S. Artenstein, MD, chief of the Department of Bacterial Diseases at Walter Reed Army Institute of Research (WRAIR), has been named as the 1971 winner of the Gorgas Medal for distinguished work in preventive medicine.

In announcing the silver medal award, the Association of Military Surgeons of the United States, meeting recently in Washington, D.C., recognized Dr. Artenstein for his research in the prevention of meningococcal disease.

The author of 51 published professional papers, Dr. Artenstein is known for his research in isolating the rubella virus. He has also been recognized for his studies investigating enterovirus infections, immunity to adenoviruses and respiratory tract antibodies.

Dr. Artenstein, who took his MD degree in 1955 at Tufts University in Boston, Mass., became a Diplomate of the American Board of Internal Medicine in 1963. In that same year, he became a member of the American Federation of Clinical Researchers.

Coming on active duty in 1959, he served as a virologist at WRAIR until 1961. This was followed by further study at the New England Central Hospital, U.S. Public Health Service (USPHS), in Boston, where he also taught at the Tufts University School of Medicine.

Dr. Artenstein returned to WRAIR in 1962. Two years later, he was appointed assistant chief of the Department of Viral Diseases, Division of Communicable Diseases and Immunology at the Institute.

In November 1966 he was named chief of the Division of Bacteriology and, concurrently, served as clinical professor of Medicine at George Washington University.

The Gorgas Medal, sponsored by Wyeth Laboratories of Philadelphia, was first presented in 1942 in memory of MG William C. Gorgas whose work in preventive medicine contributed so much to the construction of the Panama Canal.

It is awarded annually by the Association and is accompanied by a scroll and \$500 honorarium.



Dr. Malcolm S. Artenstein

MUCOM Centers Developing Practical Applications for Fluidics

By Carroll H. Staley
and
Dr. A. E. Schmidlin

Just over ten years ago the Army's Harry Diamond Laboratories announced the development of devices called fluid-jet amplifiers that involved no moving mechanical parts. This disclosure launched a new technology which in 1964 became known as Fluidics.

Conceived originally to satisfy the need for logic and control devices capable of reliable operations in hostile environments, fluidic devices and systems are now under development for use in a wide variety of industrial and military applications.

Almost since the disclosure of fluidics principles, commodity centers of the U.S. Army Munitions Command (MUCOM)—principally Edgewood Arsenal near Baltimore, Frankford Arsenal in Philadelphia and Picatinny Arsenal near Dover, N.J.—began exploring possible applications of this technology to their respective mission activities.

Studies monitored by MUCOM's Research and Development Directorate were directed to developing systems and components to improve the performance of equipment in the several munitions commodity areas for which MUCOM has over-all responsibility.

A review of MUCOM's resulting activities shows that fluidics technology is at work in systems ranging from intricate fluidic safing and arming devices to less complicated inspection gauges for the primer assembly in small arms ammunition.

Fluidic principles also are being exploited in developmental devices such as the hi-performance artillery and mortar point detonating fuze, and the high-speed assembler for 20mm ammunition.

"Fluidics systems in munitions are simple, rugged and reliable under adverse environments and in addition are very cost effective." This is the opinion of Willard R. Benson, chief of Systems Development Division for fuzes in MUCOM's R&D Directorate.

Among the more advanced systems undergoing development is the fluidic safing and arming system (timers and programers) for missile warhead sections being developed by the Nuclear Engineering Directorate (NED) at Picatinny Arsenal. Anthony P. Corrado is primarily responsible for this effort.

In recognition of its inherent simplicity, reliability, radiation "hardness" (resistance) and cost savings, fluidic technology is being used in systems required to survive the hostile environments anticipated for future nuclear munitions.

A fluidic oscillator for driving arming system timers under development will possess an accuracy of $\pm .2$ percent over the temperature range of -65° F. to $+165^{\circ}$ F. In the planning stage, and being coordinated at Picatinny by Frank Timte, is a flight program which will confirm the use of fluidics for missile application.

Moreover, on-board fluidic sensors have been developed to monitor and confirm the launch pattern of a high-performance missile. A 'G' sensor, conceived by Dr. A. E. Schmidlin of Picatinny's NED to accomplish this mission has a single moving part, the seismic mass. Environmental testing has confirmed its suitability for use in a flight-test vehicle.

In other areas, electrical initiation schemes may be supplemented by the use of a fluidic initiator. This device has been extensively tested and can be used in a fluidic system for explosive squib actuation, in the same manner as electrical initiators are used.

Incorporating a resonance tube, the device is being investigated for further applications, such as velocity sensors and fuel air explosive (FAE) initiators. A production design of molded plastic confirmed its low cost and reliability; the result is these units are being incorporated into flight-test hardware.

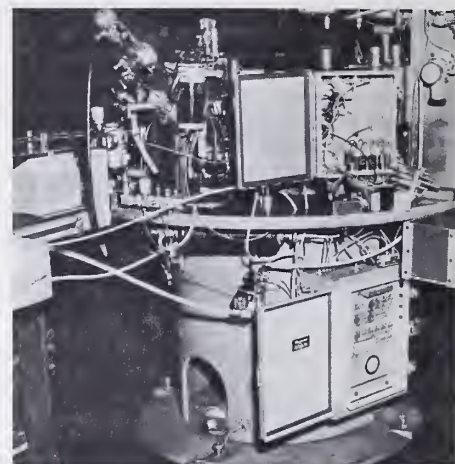
Important to munitions of the future is the hi-performance artillery and mortar point detonating fuze. A fuze study program sponsored by the Munitions Command in 1968 has proven the feasibility of a universal impact fuze, i.e., one fuze, for both artillery and mortar rounds.

Two concepts were investigated in this program. One, developed under contract with AVCO Systems Division of Wilmington, Mass., and supervised by E. Stearns, Lloyd Post, and W. Holley of Picatinny, utilizes a fluidic arming delay system.

Incorporated in this system is a Venturi airstream sensor that reliably integrates velocities between 300 to 2,200 ft/sec and provides a near constant delay distance of approximately 300 feet. More conventional components include an electrical charge generator and appropriate impact sensors.

The other concept, developed by the Harry Diamond Laboratories, involves a fluidic-electrical mechanical device. It includes a dual fluidic generator power supply, electronically delayed arming and firing circuit, and crush and inertial impact switch target sensor.

The fluidic power supply consists of a ram air-driven fluidic oscillator coupled to an electromagnetic generator assembly. Louis Richmond is the project engineer for design devel-



FLUIDICALLY CONTROLLED machine for assembling 40mm multiple-projectile cartridges is among the many significant advances in production technology developed at the Army Munitions Command.

opment and Dr. Carl J. Campagnuolo, H. S. Kimmel and H. Lee are responsible for the fluidics portion of the design.

"Functionally, fluidics is solid-state in principle, able to withstand severe field service and abuse, and still continue to perform when required," according to Benson who has spent 23 years with Army munitions programs.

Scientists and engineers at two MUCOM installations have advanced several of the industrial fluidics concepts to actual application stage. A MUCOM program of major significance that incorporates the fluidics concept is the plant modernization program. Benson commented:

"We are fortunate that fluidic technology comes of age in time for the Army plant modernization program and will allow us to make major advancements at a cost which is commensurate with the restrictions in Department of Defense."

An example of fluidic fruition in this area at Frankford Arsenal is the Small Caliber Ammunition Modernization Program (SCAMP). Involving a revolutionary engineering effort, it is aimed at applying the most advanced production concepts to GOCO (Government-owned, contract-operated) plants. The goal is to speed up ammunition production to 1,200 assemblies per minute.

Fluidic devices were selected over other types of controls because of their greater expected useful life and easier maintainability.

Frankford Arsenal reports saving more than \$100,000 in the initial operation of a fluidically controlled ammunition assembly machine for the 40mm "multiple-projectile" cartridge. This is a successful adaption of the principles to sequencing and gauging.

In another instance, a high-speed assembler for 20mm ammunition, using limit switches for sensing and controlling, was plagued with costly down-time due to setting drift and wear. Fluidic-equipped machinery was installed and has been running at 100 cycles per minute on an 8-hour shift for more than a



★ ★ ★
Dr. A. E. Schmidlin (left) is senior research scientist for the Fluidics Group, Picatinny Arsenal, U.S. Army Munitions Command (MUCOM), Dover, N.J. Carroll H. Staley (right) is deputy director of the MUCOM Research, Development and Engineering Directorate.



year without problems. Charles D. Picozzi, who holds many patents in the fluidics field, is credited for these and other design achievements involving fluidics.

Collaborating with Harry Diamond Laboratories, Frankford metallurgists, skilled in precision investment casting techniques, have developed fluic elements the size of a quarter. Each element contains eight inlet-outlet ports and precisely controlled channels having 0.010-inch interaction zones—with room to spare.

A unique feature of this method is the investment casting of both the fluic elements and the hobbing tools for final machine, expected to improve greatly the production machinability.

A technological doubleplay by Robert A. Shaffer of Frankford's Timing Device Laboratories is in the making. His concept for an artillery time fuze couples fluidics principles with an even newer invention, ROLAMITE.

Designed to yield a potentially low-cost, high-precision, high-reliability field item, ROLAMITE is a low-friction, mechanical rolling suspension system consisting of rollers and interlacing bands.

Fluidic automatic weighing and dumping operations have been applied successfully at Pine Bluff Arsenal where B. J. Miller and M. McGrew are responsible for advancing control production applications. Considerable cost and time savings have been reported over the previously used gravimetric feed scales and hand scales.

Two experimental filling machines are being automated by the use of fluidics at Edgewood Arsenal in a project monitored by John W. Schriver and Donald K. Patton. One machine is used for the automatic volumetric metering and dispensing of a riot-control polymer agent. The second machine is used to

fill a munition with a pyrophoric agent and seal the filled munition with a double-ball closure.

"The use of fluidics in automated loading, packing and inspection minimizes the downtime while improving the safety of production machinery," Benson explained.

In the Automation Engineering section of Picatinny's Ammunition Engineering Directorate (AED), Joseph Lebzelter completed an application study relative to the loading assembly and packing of ammunition.

Results showed that available fluidic components could be combined into control sys-

tems with improved safety, reliability, maintainability and reduced cost compared to alternate control media.

A prototype fluidic control system has been incorporated in the 2.75-inch rocket safing and arming inspection system in this effort, and a pilot line for a rework operation on LAW rounds is in operation at Picatinny.

The high degree of success achieved to date by MUCOM in the field of fluidics presages extensive usage of this technology for the advancement of the performance, efficiency, reliability and production/inspection of munitions systems, in the view of investigators.

ABMDA Announces Contract to Establish ADTEC

Consolidation of a number of separate facilities is the objective of a contract signed Dec. 8 for establishment of the Army Ballistic Missile Defense Agency's Data Processing Testbed and Evaluation Center at Huntsville, Ala.

Announced by ABMDA headquarters in Washington, D.C., the center will be known by the acronym ADTEC and will be located near the ABMDA office in Huntsville. BMD data processing subsystems generally are characterized by machine instructions executed at the rate of millions per second.

The ADTEC, it was explained, will concentrate on determining software effectiveness and advancing software technology in the areas of design, development and testing of real-time BMD software.

As applied to BMD, real-time is measured in terms of microseconds. The center will develop methods for running benchmark tests on computer hardware and software to measure their applicability for ballistic missile defense.

The ADTEC will be able to evaluate anything from individual algorithms to the entire BMD process, including engagement logic and real-time control of the process. This will involve extensive use of simulations as well as the actual running of portions of BMD processes under development.

The ADTEC is being established as one of ABMDA's actions toward creating a center of excellence in the design, development and testing of advance techniques in BMD data processing.

CDC Center Responding To Industrial Requests

Statistics score a solid success for the first year of operation of the U.S. Army Combat Developments Command Research Industry Documentation Center at Fort Belvoir, Va.

Established to provide industry with necessary information early during the Concept Formulation Phase of the life cycle management system for items of military materiel, the center is located in a small trailer.

Qualified industrial research and development representatives may receive, in sanitized form (that is, cleared for security requirements), draft-proposed, proposed and Department of the Army approved objectives and requirements documents. The center also enables the Army and industry to exchange ideas about R&D activities.

Nearly 600 companies have sent representatives to the center and they have studied more than 4,000 documents in their search for information. Industries can get permission to use the center in four ways.

- Expressing a desire to participate in the Army R&D program.
- Obtaining the required and industrial facility clearances.
- Providing evidence of an R&D capability.
- Demonstrating need-to-know for the information.

Information is available on present and future Army materiel requirements. This enables industry to develop independent research programs to meet the Army's anticipated needs.

The center has a 24-hour, 7-day week telephone service—Area Code 702-664-1615. Appointments and inquiries may be made by telephone or by writing directly to: Research Documentation Center, Combat Developments Command, Fort Belvoir, Va. 22060.

Simplified, It's Dr. Sury K. . . .

Picatinny Chemist Qualifies as Top Tongue-Twister

Arm-twisters still come "a dime a dozen" despite inflation at Picatinny Arsenal, Dover, N.J., but one of its Feltman Research Laboratories' physical chemists is in a class all by himself as a tongue-twister.

To associates he is known as Dr. Sury K, which is short for Kalyanasundaram Suryanarayanan. That's the longest name in the Picatinny Arsenal telephone directory, if not any Army research and development center.

Dr. Sury K (the full name is almost as hard to type as pronounce) has been employed at the arsenal since September 1968. His research specialty is the photochemistry of explosives, involving the decomposition properties of explosives induced by light.

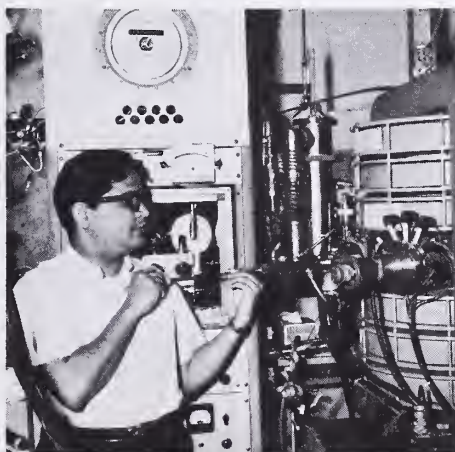
Objectively, his investigations will reveal why explosives are metastable (unstable), why they decompose, with emphasis at the molecular level.

Dr. Sury K uses such instrumental techniques as infrared, ultraviolet, nuclear magnetic resonance and electron spin resonance spectroscopes.

He came to the United States in 1962 with a thorough knowledge of the English language, learned in schools in his native city of Bangalore, India and at the University of

Mysore where he graduated with a BS degree. He obtained his PhD from Boston University in 1968. For three years he was a research chemist with the Indian Atomic Energy Establishment in Bombay.

One of his published technical reports is titled "Photochemical decomposition of secondary nitramines."



Dr. Kalyanasundaram Suryanarayanan

Forecast Set FY 72 R&D Effort at \$30.1 Billion

(Cont. from inside front cover)

R&D dollars. The forecast sees industry performing nearly \$21.3 billion of R&D out of the predicted 1972 total of \$30.1 billion. Of the \$21.3 billion, well over half—\$12.5 billion—will be from industry's own funds, the remainder being funded by the government.

Industry's support of R&D is particularly difficult to predict for 1972, since price movement will be seriously influenced by the actions of newly appointed price and wage control boards. Recognizing these uncertainties, the forecast calls for total industrial funding of R&D to rise 8.1 percent, but the funds it supplies for research conducted other than "in-house" will rise only 5.5 percent.

During the coming year, industry can thus be expected to increase its proportionate support of R&D, but to keep more of the resultant activity in-house.

Estimating corporate funded R&D by broad industry groups, the forecast identifies the top spenders as: (1) transportation equipment and missiles, with 1972 R&D expenditures of \$2.8 billion; (2) electrical equipment and communications, \$2.7 billion; (3) machinery, \$2 billion; and (4) chemical and allied products, \$1.9 billion.

Colleges, universities, and independent nonprofit research organizations fund and conduct research supported by federal agencies and by industrial firms. The 1972 forecast

is that these institutions will provide 4.7 percent of all funding, reflecting, in part, money received from foundations and state and local governments. They are, however, expected to perform about 15.7 percent.

Costs of R&D inputs are expected to continue to rise but probably at a lower rate, the forecast states. By the more optimistic of its two assumptions, it is possible that the real amounts of R&D effort that can be supported by expected expenditures will turn upward for the first time since 1968.

Dr. W. Halder Fisher, an economist at Battelle's Columbus Laboratories, prepared the forecast. Data were drawn from various sources, including the fiscal-year figures of the U.S. Bureau of the Budget; National Science Foundation; the McGraw-Hill Survey—Business' Plans for R&D Expenditure.

MICOM Blueprints New Development Methodology

Revision of The Army Missile Plan, a comprehensive, classified description of systems the Army needs in the future, and the technology and resources envisioned to develop them, will incorporate several innovations.

The Army Missile Command, which issues the plan to Army agencies, also is preparing a special version for use by industrial contractors who establish a need-to-know requirement for the information.

Traditionally, The Army Missile Plan has analyzed future needs in missilery and offered various approaches to achieve certain objectives. The forthcoming revision will state weapons concepts that could meet the requirements set out in existing needs. The cost is summarized for each concept, in contrast to over-all costs of programs used previously.

Material Needs, which have replaced Qualitative Material Development Objectives (QMDOs) and Qualitative Materiel Requirements (QMRs), specify future weapons requirements in terms of bands of performance. For example, instead of simply stating numbers such as 3,000 rounds per minute, a span such as 2,700 to 3,200 is given.

Material Needs represent agreement between the user and developer before they are stated. Foreign systems have been introduced in the new version, as have analyses of product improvement on current systems, on the

theory that it might cost less to improve weapons now on hand.

Included in the plan are some non-weapon requirements, such as target missiles and rockets for meteorological research. Highlighted is the pacing technology required to

bring each system concept to a stage of technical feasibility. Shown also are requirements for which no concept is offered.

Edward Dobbins, Dr. Julian Kobler and Jesse Frampton of the MICOM Directorate for Research, Development, Engineering and Missile Systems Laboratory conceived the methodology for the first Army Missile Plan in 1969.

Reservist Draws Assignment as Special Assistant to Chief of R&D

COL John H. Neiler, a Signal Corps Reservist recently assigned as a Mobilization Designee (MOB DES) in the Office, Chief of Research and Development, will serve as a special assistant to Chief of R&D LTG William C. Gribble, Jr.

His previous MOB DES assignment was with the Aberdeen Research and Development Center, Aberdeen Proving Ground, Md. COL Neiler also served as the commanding officer of the 304th Mobilization Designation Detachment (R&D) in Oak Ridge, Tenn.

In civilian life, COL Neiler is vice president and technical director (physicist) of nuclear instrumentation for the Oak Ridge Technical Enterprises Corp., Oak Ridge, Tenn.

He holds a BS in physics and engineering (1947), an MS in physics (1950), and a PhD in physics (1953), all earned at the University of Pittsburgh.



COL (USAR) John H. Neiler

COL Neiler entered federal service in January 1943 and served in the European Theater of Operations until May 1946. During this time, he was assigned as the executive officer, 3d Battalion, 517th Parachute Infantry Regiment and as Regimental S2 of the 505th Parachute Infantry Regiment. His awards and decorations include the Silver Star, Bronze Star and Purple Heart.

A graduate of the Signal Officers' Advanced Course and the Command and General Staff College, COL Neiler joins BG Harry L. Willard as special assistant to the Chief of R&D (MOB DES).



NATO WORKING GROUP for Chamber Pressure Measurements of NATO Sub-Panel 1, 7.62mm and 9mm Ammunition, discussed characteristics of piezoelectric ballistic pressure transducers and examined a display of NATO weapons during the group's 3d Technical Meeting at Frankford Arsenal, Pa. From left are: Charles L. Fulton, Frankford Arsenal (representing the

United States); LTC Quinn Flowers, United Kingdom; Dr. Horst Nebel, Federal Republic of Germany; Ishmet Erenberk, NATO Secretariat Staff; Grey Chevallier, France, chairman of the working group; George Cox and George Parker, Canada; Leslie Pool, UK; Maurice Gennigens, Belgium; George Herbert, Canada.

DORF . . .

10 Years Later

Concern about potential hazards to public health and safety expressed when the Diamond Ordnance Radiation Facility (DORF) was established as the U.S. Army's first nuclear "pulse" reactor has proved unwarranted during a decade of operation.

In fact, most of the residents near Forest Glen, Md., where the facility is a part of the Walter Reed Army Medical Center annex, have long since forgotten or are blissfully unaware that DORF exists.

In January 1972 DORF marked 10 years of what researchers consider highly successful experimentation. The records show that it has served requirements of the Navy, Air Force, other Department of Defense agencies or contractors, and a few Allied countries, in addition to those of the U.S. Army.

Under rigidly controlled laboratory conditions, highly trained scientists proceed with experiments that are adding continually to improved understanding of nuclear radiation effects. Investigators are concerned with determining results and protective measures involving electronic components, systems, and circuits in missiles and other military materiel.

During a typical year, such as 1970, the reactor generated a total power of 45,000 kilowatt hours and performed 238 pulsed experiments. Irradiation studies utilized the facility 221 days.

In 1971, DORF increased its steady-state generation of power because of requirements for isotope production in support of Walter Reed Army Medical Center (WRAMC) programs. Walter Reed Army Institute of Research (WRAIR) also called on DORF for isotopes for use in development of radiation prophylaxis and hospital patient care.

The 9-member permanent DORF staff assists experimenters in setting up and coordinating their tests. It includes: 1 physicist, 1 assistant physicist, 3 reactor operators, 2 health physicists (provided by WRAMC), 1 mechanical-electrical technician, 1 secretary.

Radiation damage studies performed at the facility this past year were generally a continuation of similar experimental programs carried out in previous years. One of the continuing programs involves component characterization studies which give statistically meaningful data on the nuclear radiation damage to components, primarily semicon-

ductor devices, when exposed to various neutron fluence levels.

Another concerns experimental programs for the irradiation of subassemblies for use in nuclear hardened weapon systems. The general types of electronic systems used in these programs include: time base modulators, ac-dc converters, video amplifiers, logic circuitry, and subassemblies of fuze systems.

Some of the tests have been performed on systems used in the Army's Safeguard ballistic missile defense, the Army Sergeant, Lance and Shillelagh missiles, amorphous semiconductor switches and magnetometers.

Other experiments have involved segments of the Navy's Polaris submarine missile system, modules used in naval ship ordnance and avionics, and Air Force reentry vehicles.

The nuclear core of the reactor is sus-



DIAMOND ORDNANCE Radiation Facility, showing nuclear pulse reactor (center) and control room (upper right) for tests.

pended from a movable carriage and rests at the bottom of an aluminum-lined tank of demineralized water 20 feet deep and about 14 feet wide. Mobility of the core assembly permits radiations to be directed within the reactor pool or into an adjacent dry, shielded exposure room large enough to accommodate complete systems assemblies and large-scale components.

The facility boasts an outstanding safety record throughout its 10-year operation. In this time there has not been a single accident, even though the facility is widely used. DORF, located in a light industrial area, has been used by such agencies as: WRAIR, WRAMC, Picatinny Arsenal, the Electronics Command (ECOM), Naval Ordnance Laboratories (NOL), Bell Telephone Laboratories, Lockheed, and many others.

Over the years, this facility, still the only one of its type owned and operated by the Department of the Army, has been visited by numerous scientists and engineers interested in inspecting its successful operation.

Harris Directing New Office For MICOM Work on Redeye II

Development of Redeye II, a proposed new man-portable air-defense weapon system evolved from basic Redeye technology over several years, will be directed by a new management office at Redstone Arsenal, Ala.

A high-performance propulsion system and sophisticated guidance controls are expected to give Redeye II a longer range and higher velocity than the original Redeye system. A night-sight capability and a device to identify aircraft also are being considered.

Hoyt Harris, former deputy project manager of the Air Defense Control and Targets (ADCAT), is directing the new management office. Initially, it is authorized two military officers and 26 civilians, to be staffed primarily from elements within the U.S. Army Missile Command.

MICOM has recently released a Request For Proposal to General Dynamics, Pomona, Calif., for engineering development of the shoulder-fired system.

. . . Aspects of Radiological Safety—

Health physics support for the DORF is supplied by Walter Reed Army Medical Center under an agreement between the commanding officer, Harry Diamond Laboratories, and the commanding general, WRAMC.

The WRAMC Health Physics Office provides surveillance of the facility and supplies its personnel monitoring devices.

Individuals expecting to spend at least four hours a day in the facility are issued film badges and pocket dosimeters. Persons staying less than four hours are given only pocket dosimeters.

. . . As to Environmental Radiological Monitoring

The WRAMC Health Physics Office also serves DORF by monitoring radioactivity levels of Army nuclear reactor facilities in the area. It compares fallout-washout data to the total deposition of precipitation as reported by the U.S. Public Health Service (USPHS) Radiation Alert Network. The USPHS site in Baltimore, Md., is used as the sampling station against which data collected at WRAMC is evaluated.

In addition, air and soil samplings are taken to determine average monthly depositions in the WRAMC environment.

Over the years this monitoring has shown that operation of the nuclear reactor facilities in the WRAMC environment has not significantly contributed to a change in the ambient radiation levels, as determined in various operational impact analyses.



REQUEST FOR FIRE SUPPORT

UNIT COMMAND POST

SENSORS

FLARE

SENSOR SIGNALS

SENSORS

READOUT EQUIPMENT

A TACTICAL APPLICATION

